RAILWAY Mechanical and Electrical Engineer

A Test for Lubricating Oil Stability

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Fig. 1

THE present use of heavy-duty oils in diesel locomotives has presented many problems to those in charge of lubrication. Since there are a great many of these oils available, each compounded with different additives, the problem of selection and comparison has, indeed, been most complex and difficult.

While the generally accepted methods of lubricating analysis of diesel lube oils have been very valuable, they have not always been compatible with test engine results.

The Research and Test Department of the Seaboard Air Line under the direction of W. D. Simpson, chief engineer, has, for some time, been investigating various methods of oil analyses for the purpose of evaluating new oils and the control of oils in the diesel engine crankcase.

While setting up the program for this work, I noticed that the United States' Bureau of Standards had developed a laboratory test for rating lubricating oils, known as "Stability Test for Additive-Treated Motor Oils," which had given good results and appeared to be very promising.

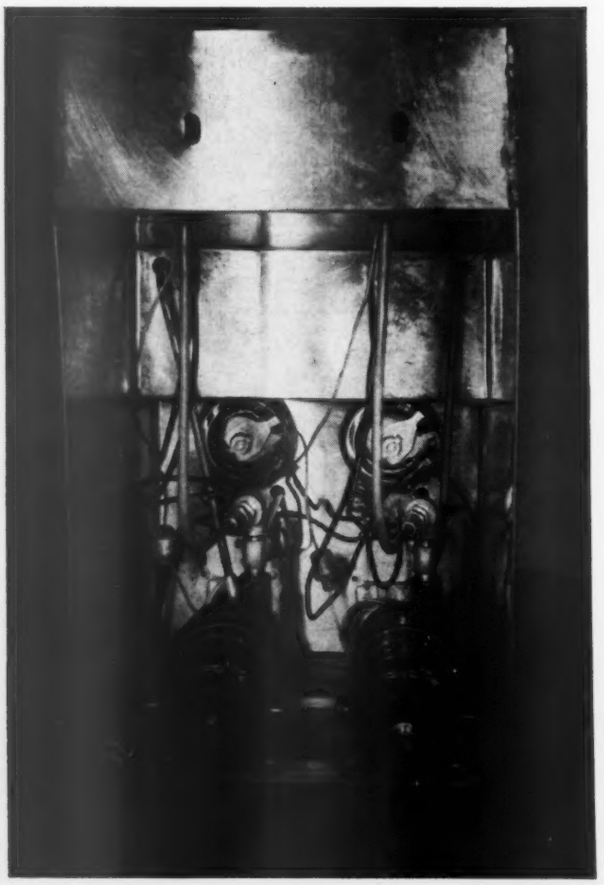
This method evaluates oils on the basis of characteristic deposits formed instead of actual changes of the oil in bulk.

Since, in the lubrication of the diesel engine, engine deposits are of prime concern, it is very desirable to know the point where additives have ceased to function.

A simple reliable laboratory method has been needed which would not only give the comparative amount of deposit which could be expected of un-used oils, but would also indicate when the additives in crankcase oils have become exhausted and of no further value.

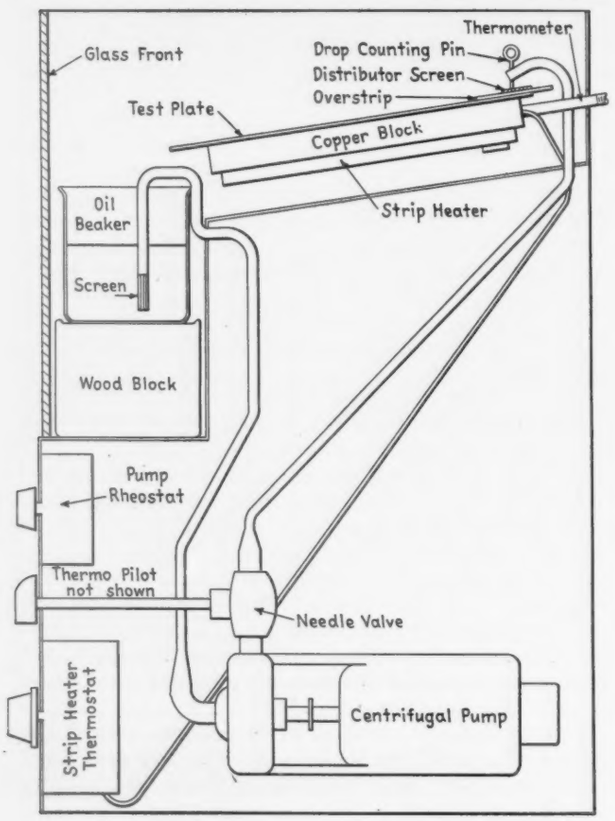
Extensive tests were begun in the Seaboard's Research and Test Laboratory at Jacksonville, Florida, to determine the value of the Bureau of Standard's stability test in comparing un-used oils and determining the condition of used diesel crankcase oils.

The test is fairly simple in principle, consisting of the flowing of a thin film of oil over a heated steel strip in the atmosphere and recirculating the oil for a definite period.



▲ Fig. 2

▼ Fig. 3



In order that the test results be comparable, it is necessary that the equipment used be capable of maintaining accurate oil film temperatures and flow rates within desired limits, and the tests run for two six-hour periods should be as completely automatic as possible.

The first tests in the Seaboard laboratory were made on similar equipment used by the Bureau of Standards and described in Analytical Chemistry, Vol. 21, May 1949, page 508, under "Stability Test for Additive-Treated Motor Oils." This equipment was found difficult to adjust and failed to give uniform results without very close attention.

In order to overcome the difficulties experienced with the Bureau of Standards' equipment, the apparatus shown in Figs. 1 and 2 was designed and built in the Seaboard's laboratory. Fig. 1 is a front view showing control panels, beaker, and test strip, while Fig. 2 shows the rear of the control panel and the centrifugal pumps. In Fig. 1, the left hand unit is complete with test strip and beaker ready for operation, while the right hand unit has test strip and beaker omitted.

Referring to Fig. 3, which is a diagrammatic sketch showing the arrangement of the principal parts, it will be noted that a strip heater is mounted in the upper right hand corner and on this heater a copper block is fastened. This copper block is 7 in. long, 1.5 in. wide and $\frac{7}{8}$ in. thick. The test plate, a steel strip 9 in. long, 1.75 in. wide and $\frac{1}{32}$ in. thick is fastened by eight steel machine screws—four on each side. The test plate overlaps the copper block and is pointed on one end.

Heater, copper block and test plate are inclined toward the oil beaker at the specified angle so that the oil may drop from pointed end of test plate into the beaker.

The overstrip is made of steel, 3 in. long, 1.75 in. wide and $\frac{1}{32}$ in. thick and is fastened at the upper end overlapping the test plate 2.5 in. The distributor screen consists of a piece of doubled 20-mesh steel wire screen, 1.25 in. long and 0.625 in. wide, and is placed on the overstrip to assist in spreading the oil evenly over the test plate.

The copper block is drilled to receive a thermometer and a thermostat bulb. The oil circulating pump is a small laboratory centrifugal pump, and rate of flow is controlled by rheostat regulating the pump speed and a needle valve in the pump discharge line.

Drop counting pin is used to give a quick check of oil flow rate. The drop rate is calibrated against delivery in grams per minute of oil.

The suction line of the pump, fitted with a fine mesh screen, is immersed in oil contained by beaker. The oil is pumped from oil beaker through needle valve control to drop-counting pin.

The equipment contains two test units so that two oils may be run simultaneously.

The test strip and overstrip are prepared for the test from $\frac{1}{32}$ in. galvanized sheet iron by stripping the galvanizing with 15 per cent HCl, washing with pumice soap, rinsing with tap water then distilled water, and dried. When this is done the test strips are weighed.

After the system has been flushed with test oil and adjusted, 130 grams of the test oil are weighed into a 250 ml. beaker. The beaker is placed in position, as shown in diagram Figure 3. This beaker is located so that it receives all oil which drops from pointed end of test strip. The steel overstrip and distributor screen are placed in position. The suction line of the pump is immersed in test oil contained in beaker.

The pump is then started and heater turned on. The temperature of the oil and of the test strip is controlled by means of the thermostat-bulb inserted in the copper

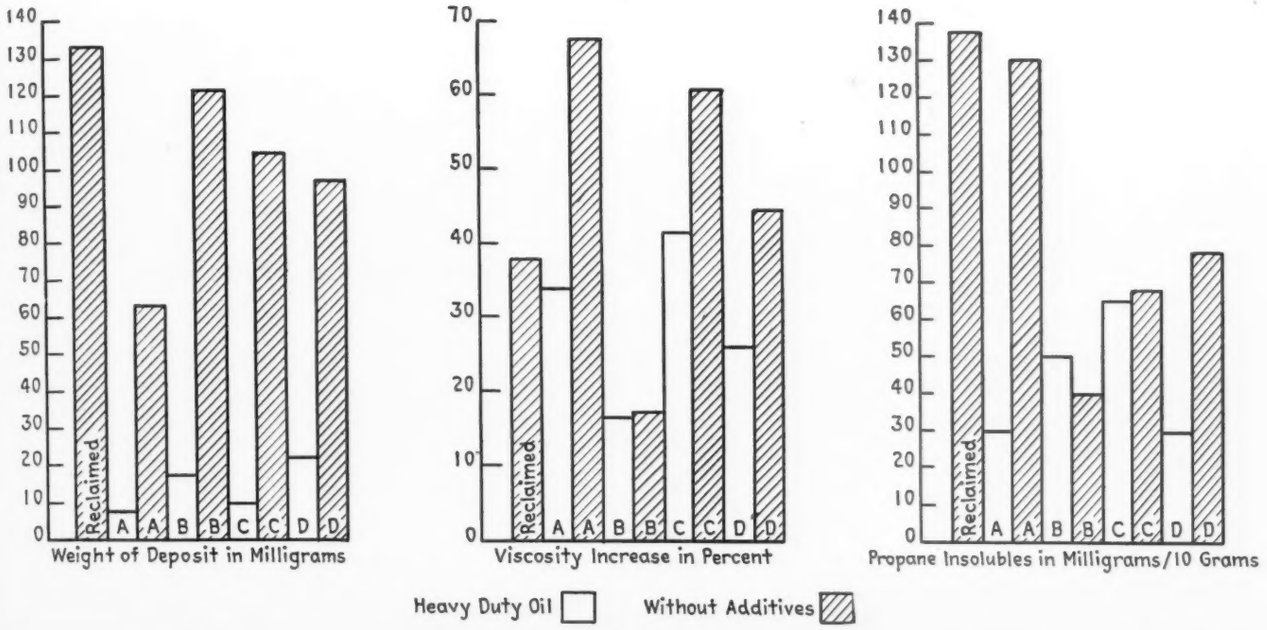

Weight of Deposit in Milligrams
Viscosity Increase in Percent
Propane Insolubles in Milligrams/10 Grams
Reclaimed
A A B B C C D D
Heavy Duty Oil
Without Additives

Fig. 4

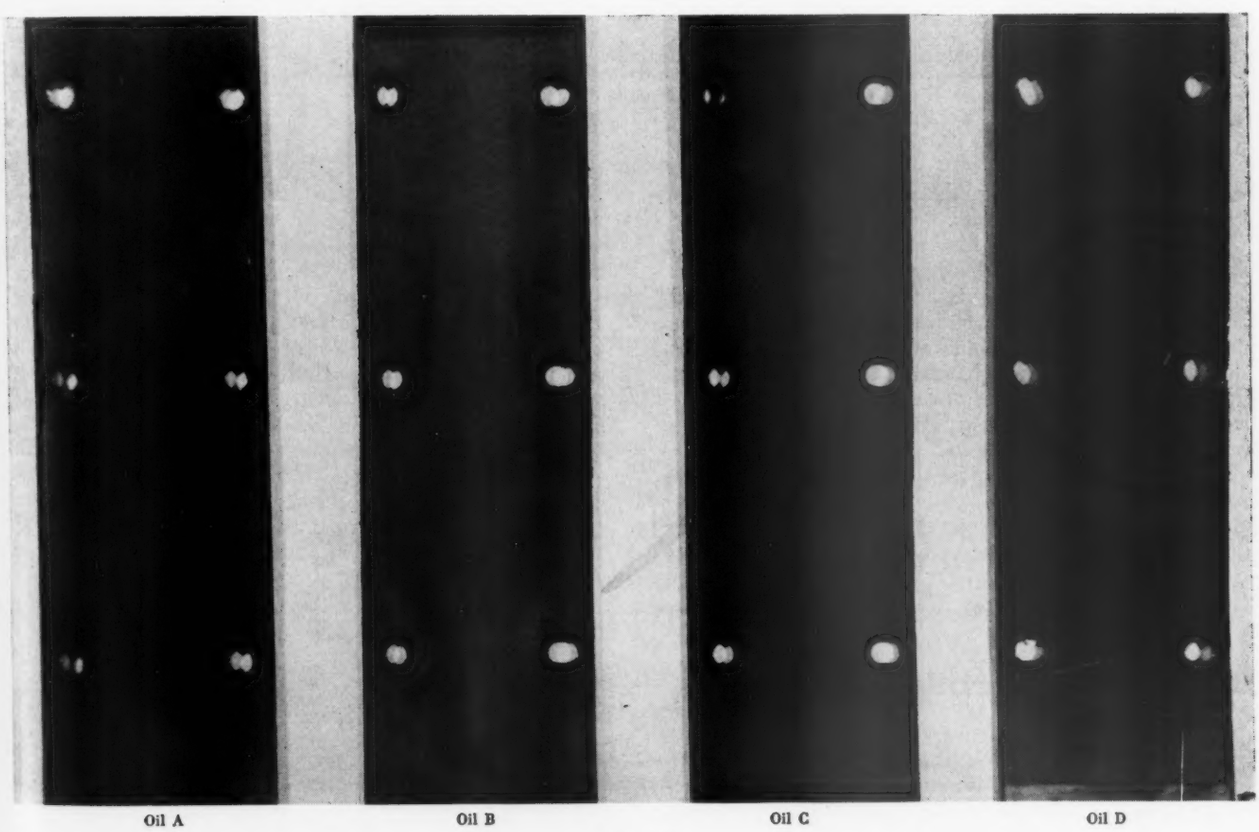
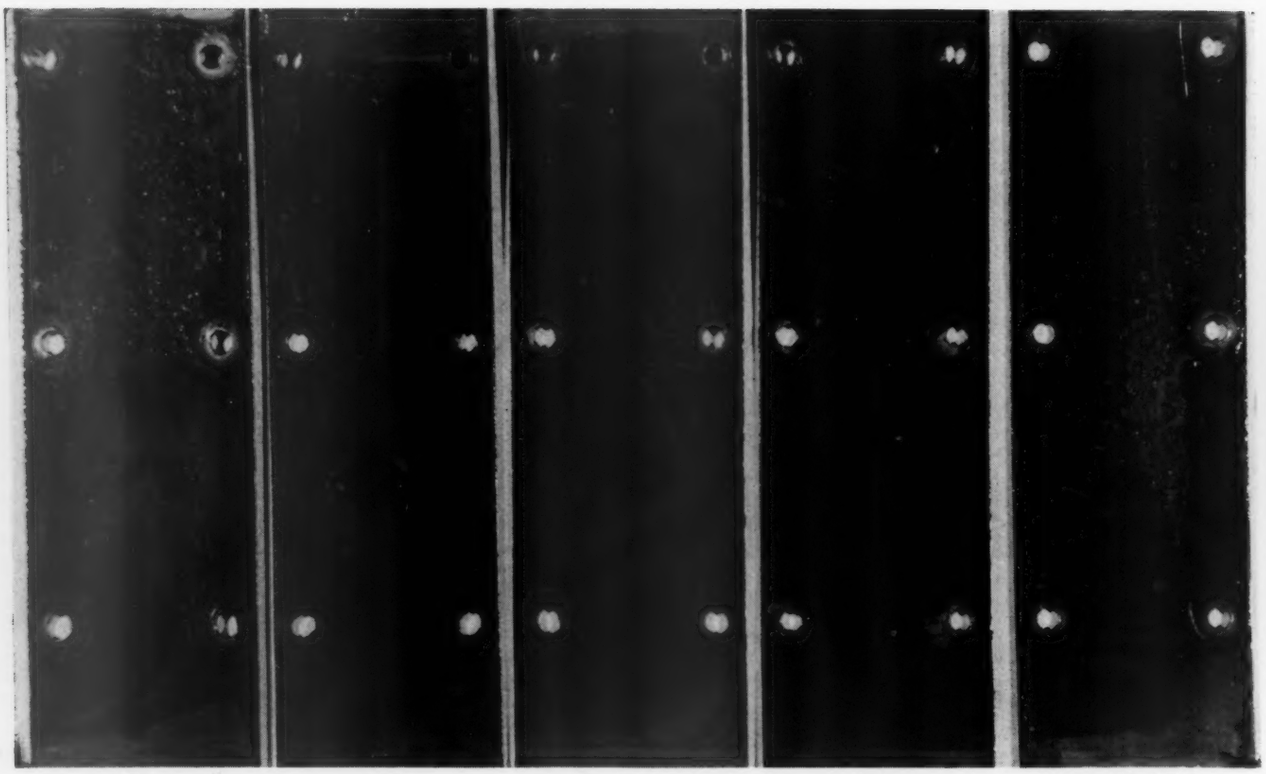


Fig. 5

block, which is connected to the strip heater thermostat. This regulates the heat given off by the strip heater and maintains a constant temperature at any pre-determined value. Oil flow is regulated by means of the rheostat which controls pump speed and the needle valve in the oil discharge line. The test temperature is usually reached in about 0.5 hours and this temperature is held constant for period of test, two runs of 6 hours each.

At the end of the test period, the heater is cut off, the pump stopped, and the test plate removed. It is allowed to drain thoroughly, and is then cleaned with precipitation naphtha. In cleaning, the test plate is inclined, a strip of cotton gauze placed on the top of the test plate, and the other end of the cotton gauze immersed in a



Oil A | Oil B | Oil C | Oil D | Reclaimed Oil

Fig. 6

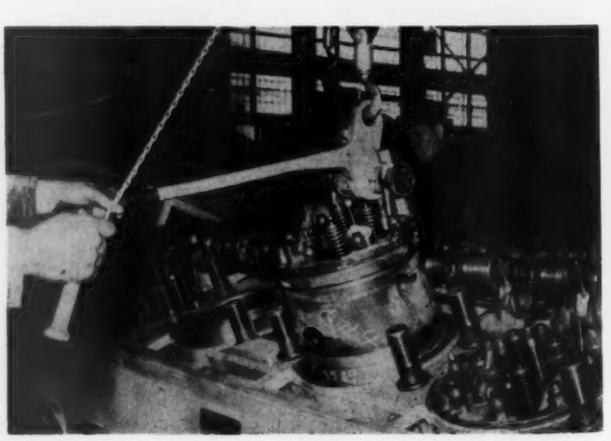
beaker of precipitation naphtha which is elevated higher than the end of the test plate.

This provides a gentle flow of naphtha over the test plate which washes all oil away without disturbing the deposit. The washing is continued on alternate sides of the test plate until the naphtha dripping from the test plate is colorless. The test plate is then dried and weighed. The difference in the weight of the test plate before and after the test is the amount of deposit formed during the test. Viscosities at 100 deg. F. and propane insolubles were run before and after tests.

Fig. 4 is a chart which gives, graphically, some typical results which have been obtained with the stability apparatus. In this case, a reclaimed oil was run, also four different base oils with and without additives. The base oils were obtained from four different oil companies, each of whom furnished a base oil without additives and the same base oil compounded with additives, as furnished for heavy-duty additive type oils.

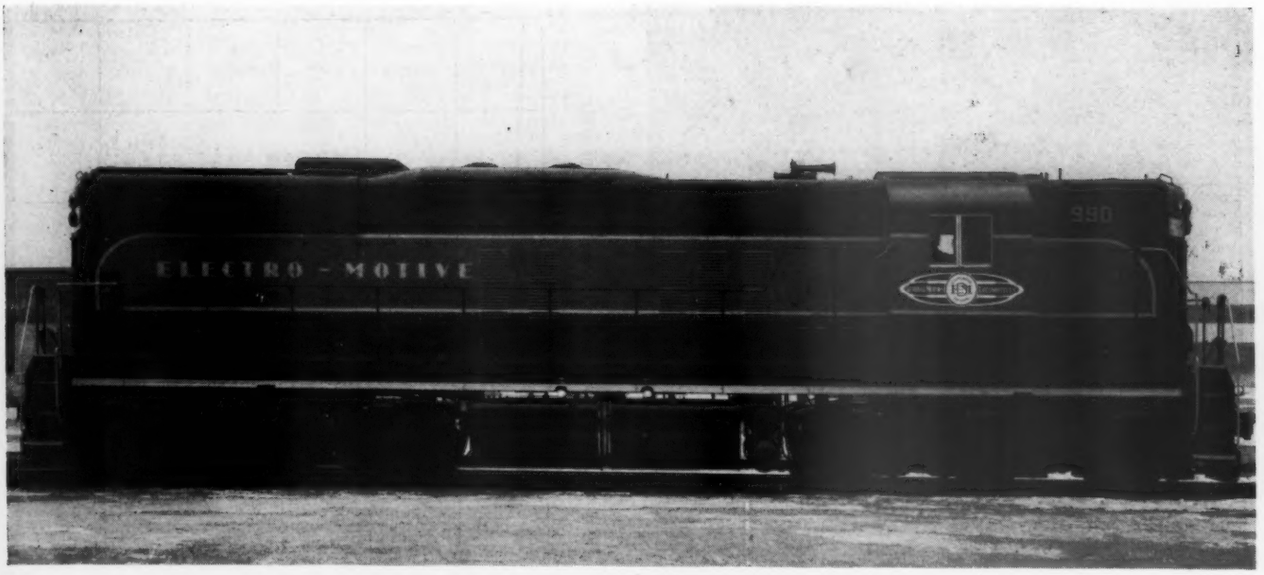
In the chart, Fig. 4, indicating weight of deposit, for example, base oil A shows approximate 63 mgs. of deposit, which base oil A compounded with additive for distribution as a heavy-duty additive type oil shows approximately 8 mgs. of deposit. After the test is run, the test oil shows an increase in viscosity and an increase in propane insolubles. Two photographs are included which show the affected areas of the test strips. Fig. 5 is heavy-duty oil and Fig. 6 is the same base oil without the additives. The oils designated by letters in Figs. 5 and 6 are the same oils as shown on chart in Fig. 4.

Diesel Liner Lifting Device



The lifting device shown in the illustration is used for removing diesel cylinder liner assemblies and reapplying them to the cylinder blocks. The lifter, being offset 2½ in. with a used rocker arm shaft welded to the lifter at a proper angle, permits lifting the assembly at a 22½ deg. angle. The handle acts as a guide while lowering the assembly into place.

The center distance of the two holes in the working end is 5½ in. and the end of the handle is about 29 inches from the fulcrum hole. An E.M.D. lifting eye and piston holding rod with retaining washer to keep the piston and connecting rod in the assembly while being lifted out of the cylinder block.



No. 990, the first G.M. diesel locomotive of the SD-7 type.

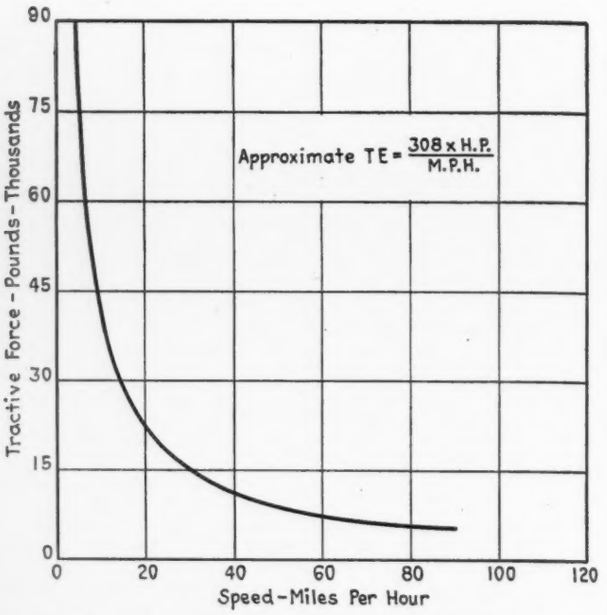
E.M.D. Builds Six-Wheel Switcher for Special Duty

Front end construction and safety appliances.

THE Electro-Motive Division, General Motors Corporation, LaGrange, Ill., is currently demonstrating a new Type SD-7 heavy-duty diesel road-switcher of 1,500-hp. capacity, with three traction motors geared to equally spaced wheels in each of two swivel trucks designed for exceptional flexibility and safe, smooth riding at high speeds. The locomotive weighs 52,343 lb. per axle and, with a 62 to 15 gear ratio, develops 78,515 lb. tractive effort at 25 per cent adhesion. Since January, it has been demonstrated on 10 of 32 scheduled railroads throughout the country and shown excellent results in a variety of services including heavy transfer, humping, helper, mixed trains, through and local freight, and yard switching.

For example, one road reports handling 1,500-ton trains on a 5-mile, 2-per cent grade with outstanding

Flexi-Coil easy-riding truck with three motors geared to equally spaced wheels. The bolster is removed (below) to show coil spring supports and easily accessible center motor.



Relation of speed to tractive force developed by the SD-7.

adhesion due to automatic sanding in conjunction with wheel-slip control. Another road reports one move in level territory with 102 cars weighing 5,500 tons, and 128 miles in heavy transfer service without wheel pick-up on rails made slippery by drizzling rain or snow. One report mentions exceptional ability to "kick" cars in yard switching and said that adhesions up to 25 per cent were attained on a 2-mile, 2-per cent grade. On one western carrier, the locomotive accumulated 1,966 miles, including 1,110 miles on seven freight-train assignments, 726 miles on five mixed train runs and 130 miles in a helper move when a minimum speed of 15 m.p.h. was maintained on the critical grade with a heavy train and the fuel consumption averaged 3.1 gal. per mile. On these tests, operating crews reported unusually easy-riding at 65 m.p.h.

In one passenger-train test run of 134 miles where a 4,000-hp. steam locomotive is normally used in order to make the schedule, the SD-7 was able to handle relatively light Sunday passenger and baggage business and save 1 hr. 14 min. on a 5-hr. schedule. An outstanding performance in transfer service, reported by a copper company in Utah, was the handling of 28 empty freight cars weighing 432 tons up a 4 per cent grade at a speed of 8 m.p.h. without excessive motor heating or wheel slippage.

In another test, the locomotive operated for 28 min. on a ruling grade with 24 automatic sanding applications totaling 8 min. and only three wheel slips. By way of contrast, a full train of 107 loads and 7 empties, or 9,614 tons, was handled on a 20-mile downhill run with the dynamic brake, air being used only three or four times to keep the train speed below 30 m.p.h. During this operation, full main reservoir air pressure was maintained by the provision for holding engine speed at 500 r.p.m. while in dynamic brake.

Condensed Specifications

The SD-7 locomotive is the newest in the General Motors No. 7 series, driven by one 16-cylinder 567 diesel engine with D-12 generator and alternating current accessory drive, the same as in F-7 freight and GP-7 general-purpose units. High capacity dynamic brakes and a 2,500-lb. per hr. steam generator are supplied as optional equipment. Roller bearings are standard and the WXG air compressor direct-driven from the engine shaft has a displacement of 336 cu. ft. per min. at 800 r.p.m.

The locomotive is 60 ft. 8½ in. long over couplers, has a truck center spacing of 35 ft., truck rigid wheelbase of 13 ft. 7 in., wheel diameter of 40 in. and is designed to negotiate safely a minimum curve radius of 250 deg. It has a capacity to carry 1,200 gal. of fuel oil, 1,200 gal. of water (optional), 200 gal. of lubricating oil, 260 gal. of cooling water and 50 cu. ft. of sand. The locomotive weighs 300,000 lb. to 360,000 lb. fully loaded and dependent on modifications

For heavy tonnage applications, the SD-7 can be equipped with either a 65 to 12 or 62 to 15 gear ratio, in which case the traction motors are self-protecting in most applications and operation limited only by available adhesion with speed limited to 55 and 65 m.p.h. respectively. Other gear ratios available for application where schedule rather than tonnage is the important consideration may be supplied as follows: 61 to 16, maximum speed 71 m.p.h.; 60 to 17, 77 m.p.h.; 59 to 18, 83 m.p.h.; 58 to 19, 89 m.p.h.

The Flexi-Coil Trucks

A feature of the SD-7 is the roller-bearing Flexi-Coil trucks which utilize a new principal in locomotive springing to give riding properties comparable to those of passenger locomotives. Full flexibility is secured by a "floating platform" design in which the bolster rides on

four sets of large diameter double-coil springs set in the truck frame with axles evenly spaced for better weight distribution. This coil spring arrangement is designed to give all necessary freedom of movement for full flexibility—with spring action suitably controlled by snubbers.

The result is a free-swiveling truck with each pair of wheels tending to follow the contour of the rail and carry its proportionate share of the load at all times. Tests are said to show that this can account for as much as 10 per cent less track stress with a given axle load. The construction is designed therefore to: assure better tracking with less flange wear; reduce stress on rail and structures; eliminate the tendency to turn over light rails; and provide better adhesion qualities for maximum tractive effort.

Maintenance Simplified

Simplicity and rugged design of the new Flexi-Coil truck are also said to assure ease of inspection and maintenance, due to fewer parts and the elimination of equalizers and loading pads. Brake shoes are easy to replace and, especially important, the center motor is readily accessible.

Outstanding features of the SD-7 design include: A new wheel-slip control system; clasp brake design for more efficient braking and easier maintenance; maximum interchangeability of parts with other G. M. diesel locomotives; provision of ample space for a full-grown man to change brushes easily on the center motor and of course readily reach end motors; brake shoes changeable without putting the locomotive over a pit; all major wiring and piping placed in a channel along the locomotive side with doors for easy access.

Exceptional visibility is afforded from the cab and full provision made for crew comfort and convenience, including fully automatic transition and notably smooth acceleration. The cab has forced air ventilation for summer operation and individual temperature control for winter.

Crane Shifts Loads and Straightens Car Parts

Two modifications made by the Peoria and Pekin Union to a conventional Roustabout crane with a 15-ft. boom and a 2½-ton hoist enable the crane to straighten loads shifted en route and to straighten and apply certain car parts. The first modification was simply the application of a wooden block to the channel-shaped end section of the boom. This block is expendable, normally requiring replacement about once a week, because it is soft enough to protect the lading when loads are to be shifted.

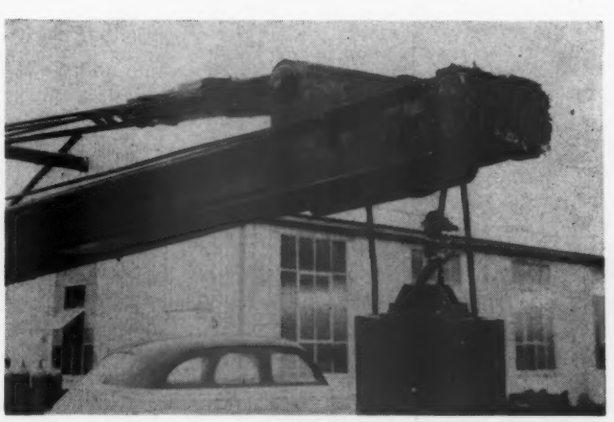
The second modification was to make the boom strong enough to perform the operations made permissible by the application of the wood block. This modification consisted of applying a reinforcing angle ½ in. by 3 in. by 5 in. along both sides of the boom from a point approximately 1½ ft. from the hoist end to 1 ft. from the car end.

The crane is used to straighten and to move for repairs all kinds of loads that have shifted lengthwise, including pipe, lumber, piling and tractors. It is also useful for reaching into gondola cars to adjust the load or to move it for repair work, and to transfer some types of loads between two different cars.

Normally loads are shifted or straightened with the crane running down a concreted runway between the rip tracks and pushing against the load as straight-on as possible. For some types of lading, such as light pipe if protected on the ends by caps, the crane can travel down the runway and push the load with the boom at right angles.

The crane is also employed for straightening side and end doors of box cars. This is done with a straight pushing action, and in conjunction with an oak timber 4 in. by 12 in. by 48 in. for even application of the force. Ladders on house cars are straightened with one end of a chain placed around the ladder and the other on the hoist. Straightening is accomplished by pulling in on the hoist, which method gives closer control than pushing by movement of the car.

Mobile crane adapted for shifting and straightening loads by reinforcing the boom and applying a wood block to the end.



The boom reinforcing angle and the expendable wooden block on the end to protect the load to be shifted.

Dynamic Testing of Freight Cars

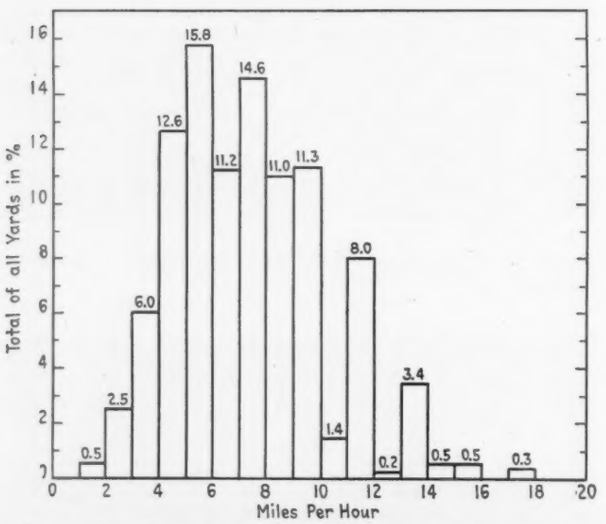


Fig. 1—Percentages of switching operations at various speeds during 555 impacts in the Chicago area.

THE Class I railroads of the United States have reportedly paid over $100,000,000 annually for loss and damage claims made against them by shippers. Of the total amount approximately 70 per cent represents damage claims which are classified under "Unlocated Damage," "Improper Handling Damage" and "Concealed Damage." In other words, a high percentage of the annual damage cost exists because of the inadequacy of the present means of packaging and anchoring lading in order to protect it from the vertical and horizontal forces to which it is subjected in train service and in classification yard operations.

It is generally conceded, although no definite figures can be established, that the most serious damage to lading occurs during switching operations in classification yards. To get higher utilization out of the present day freight car fleet the speed with which trains are made up has been increased. This in turn has resulted in cars being subjected to higher impact velocities. Fig. 1 shows a bar

* Abstract of a paper presented at the June 1952 semi-annual meeting of the A.S.M.E. by Jack M. Roehm, Associate Director of Development, Pullman-Standard Car Manufacturing Company.

Fig. 2—Inclined track for impacting freight cars at predetermined speeds up to 18 m.p.h.

graph in which the velocity of impact is plotted against the frequency of occurrence. This data was collected from a representative number of classification yard operations. It will be noted that the mean speed of impact is 7 m.p.h. This is well above the velocity of draft gear closure. In fact only 22 per cent of the impacts occur below 5 m.p.h. and it is only for impacts occurring below 5 m.p.h. that the conventional draft gears afford protection to the car and its lading.

Since the railroads must be allowed to speed up their operations in order to efficiently meet traffic demands, and since there is a limit on what package designers can achieve at a reasonable cost, it becomes imperative that the railroad carbuilders and specialty manufacturers seriously concern themselves with the problem.

The first logical step in the solution of any problem is to gain as much knowledge about the problem as possible. Technically the problem is one of dynamic loading resulting from vibration and impact. This paper covers that part of the problem dealing with what happens to a freight car under horizontal impact. To gain knowledge about freight car impacts it is necessary to have facilities for testing and adequate instrumentation for measuring test results.

Pullman-Standard started a program for dynamic testing of freight cars about five years ago. Since that time the program has been continuously expanded and improved as basic data on testing has been gathered. To provide a means for impacting cars the indoor hump track shown in Fig. 2 was constructed. A car released from the top of the hump will attain an impacting velocity of 18 m.p.h.—high enough to wreck most freight cars. By releasing the car from a predetermined location on the ramp it is possible to obtain the desired striking velocity.

Having acquired the laboratory means for simulating service conditions the next requirement is to have proper instrumentation for measuring and recording data. Wherever possible, commercially available instruments are utilized. The measurements which are of primary interest are force, stress, displacement, velocity and acceleration. SR-4 electrical strain gages are used for measuring both force and stress. For the measurement of displacement and velocity special slide wire potentiometers were developed by Pullman instrumentation engineers. Statham Model R accelerometers are used for measuring accelerations. Data from the strain gages, potentiometers and accelerometers is recorded by both Hathaway and Consolidated recording oscillographs. Multiple-channel recording is absolutely essential for studying the distribution of forces, stresses and accelerations throughout a car structure under impact loads. As many as 30 channels are recorded simultaneously. In some tests as high as 175 strain gages per car are employed to take force and stress readings from the coupler, through the car body and into the roof.

Force on the coupler is one of the most important items to be determined under test. To achieve accurate measurements a special dynamometer coupler was developed. As shown in Fig. 3 the dynamometer coupler was constructed by removing a section of a standard Type E coupler and replacing it with a hollow steel section of SAE 4140 steel. Sixteen SR-4 gages were applied longitudinally to the four outside surfaces of the section, four to a surface, and the gages were wired in such a manner that bending caused by eccentric loading would be electrically cancelled. This coupler has linear characteristics to over 1,000,000 lb.

For a loaded freight car having the conventional draft

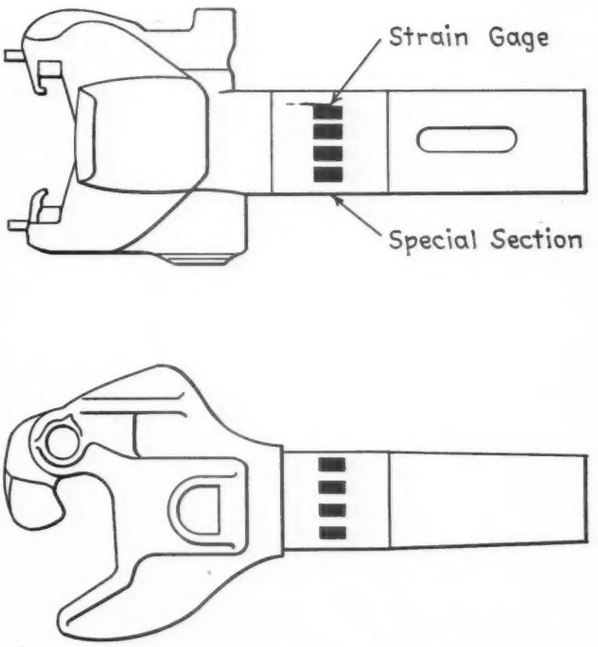
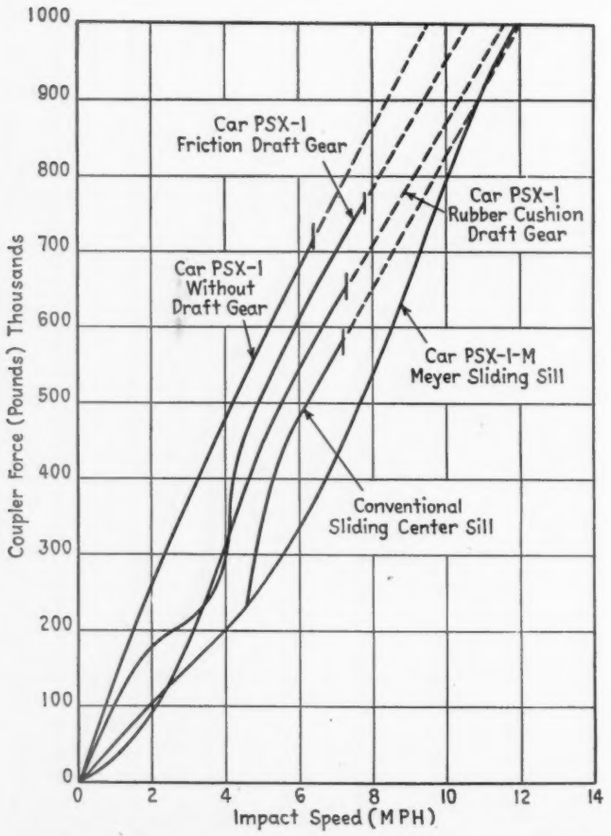


Fig. 3—Four SR-4 strain gages are applied to each of the four surfaces to determine forces on the coupler.

gear arrangement the force on the coupler can be taken as a measure of potential damage to the car structure, and the acceleration of the car body can be taken as a measure of potential damage to the lading. At first it might seem that the force on the coupler should be directly proportional to the acceleration of the car body because Newton's Second Law states that force equals mass times acceleration. The fact of the matter is that the force on the coupler and the car body acceleration are not in direct proportion. This is an important factor to remember in studying the dynamics of freight cars. The simple expression of Newton's Law is for a rigid body. A freight car is not a rigid body but is a series of masses more or less flexibly connected together. The body is one mass, the underframe another, the trucks two others, and so on, and all are flexibly connected. Newton's Law is still valid but the true expression for force is a summation of all masses multiplied by their respective accelerations.

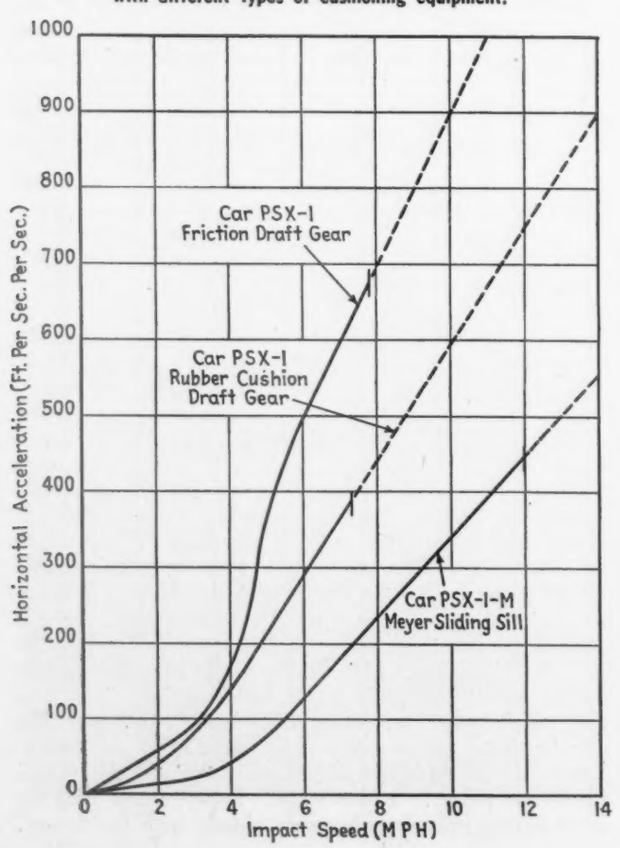
Body acceleration can be reduced by providing a more flexible connection between the body and the center sill. This will in turn reduce the force on the coupler. Flexibility between the center sill and the trucks will further reduce the coupler force due to the reaction of the trucks.

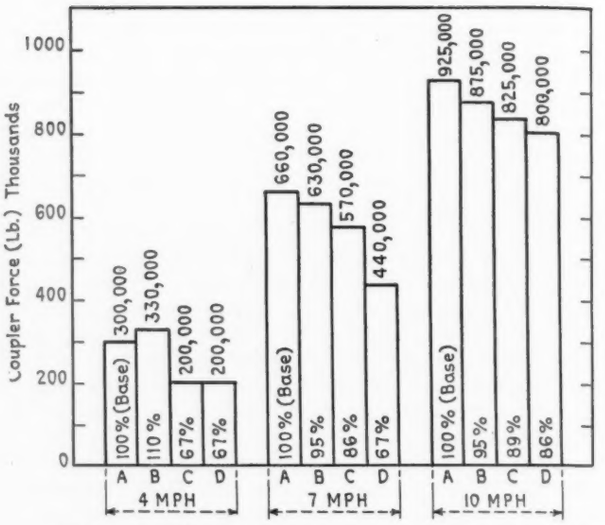
The force-time pulse which occurs during impact is equal to the transfer of momentum from the striking body to the struck body. For a given set of impact conditions, that is, given masses and given velocities, the transfer of momentum will be a constant. This is in accordance with the law of conservation of momentum which requires that the area under the force-time curve remain constant. The only way to reduce coupler force is to increase the time during which it acts. This can be done by increasing the flexibility of the complete freight car by making the structure a softer spring. The area under the force-time curve will remain constant. The coupler force for an empty box car impact can be expressed by an equation which shows that the theoretical force-time pulse is a sine wave. Experimental data on force during impact agrees very closely with the theory.


Coupler Force (Pounds) Thousands
Impact Speed (MPH)
Car PSX-1 Friction Draft Gear
Car PSX-1 Rubber Cushion Draft Gear
Car PSX-1 Without Draft Gear
Car PSX-1-M Meyer Sliding Sill
Conventional Sliding Center Sill

Weight of striking car, lb. 142,000
Weight of struck car, lb. 164,600

▲ Fig. 4—The effects of various impact speeds on coupler forces with different types of cushioning equipment.


Horizontal Acceleration (Ft. Per Sec. Per Sec.)
Impact Speed (MPH)
Car PSX-1 Friction Draft Gear
Car PSX-1 Rubber Cushion Draft Gear
Car PSX-1-M Meyer Sliding Sill



Weight of striking car, lb. 142,000
Weight of struck car, lb. 164,600
Struck Car:
A—Car PSX-1 with friction draft gear
B—Car PSX-1 with rubber cushion draft gear
C—With conventional sliding center sill
D—Car PSX-1-M with Meyer sliding sill

Fig. 5—Bar graph showing the relative effects of four cushioning equipments on coupler forces at three speeds.

Under impact conditions generally encountered with freight cars the struck car is standing still prior to being struck. Part of the energy remains in the form of motion of the two bodies. The other part of the energy, which we choose to call "Impact Effect," is the energy which must be absorbed by the draft gear, the car structure and the lading. For the idealized case of equal car weights the energy of motion is equal to the impact effect. It is the impact effect which causes damage to the car structure and lading whenever the capacity of the cushioning devices is inadequate.

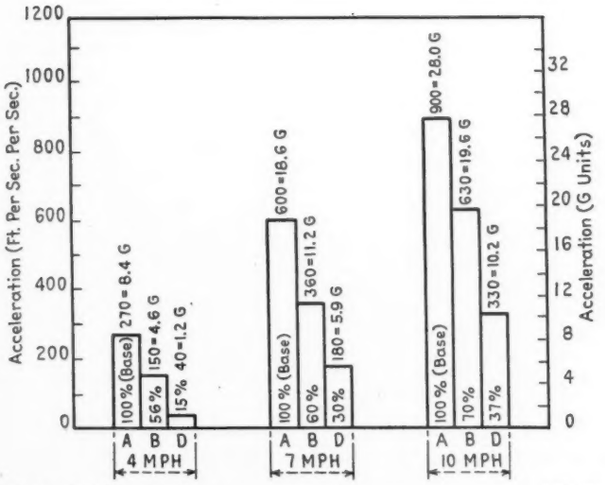
The use of the term "Impact Effect" was proposed by Wendel J. Meyer, who has been a student of the dynamics of freight car impact for about 40 years, as a means of simplifying discussions of this subject. It is suggested that the term be adopted by draft gear and car building engineers.

Fig. 4 shows some typical curves plotted from laboratory data of coupler force vs. impact speed. The conditions of test from which these data were derived were identical. It will be noticed that the characteristics of the draft gear are apparent only below speeds of 5 m.p.h. For comparative purposese, one set of tests was run without draft gear in the car. It will be seen that this curve is approximately a straight line indicating the direct relationship between force and velocity which is to be expected when impacting elastic bodies.

The values shown above 700,000-lb. coupler force have been extrapolated and are subject to question as plastic deformation can be expected to occur in car structures at these higher forces. At an impact speed of 7 m.p.h. it will be noticed that the friction draft gear exerts a force of approximately 700,000 lb. or 70,000 lb. more than the rubber cushion draft gear, 130,00 lb. more than the conventional sliding center sill underframe, and 260,000 lb.

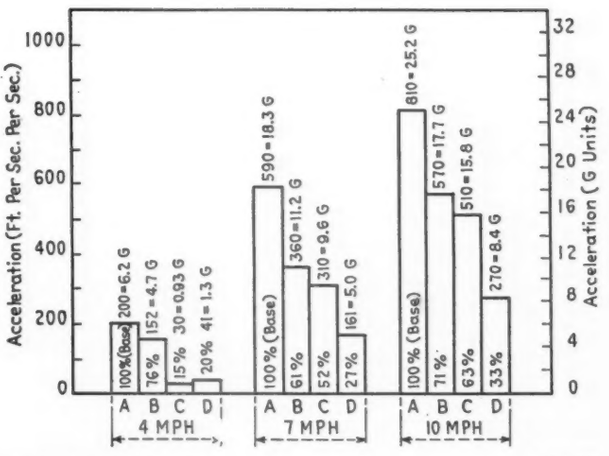
Weight of striking car, lb. 142,000
Weight of struck car, lb. 164,600

◀ Fig. 6—Curves showing the horizontal acceleration produced by impact speeds between zero and 14 m.p.h.



Weight of striking car, lb. 142,000
Weight of struck car, lb. 164,600
Struck Car:
A—Car PSX-1 with friction draft gear
B—Car PSX-1 with rubber cushion draft gear
D—CAR PSX-1-M with Meyer sliding sill

Fig. 7—The car horizontal acceleration with the Meyer sliding sill compared with the friction and the rubber cushion draft gears.



Weight of striking car, lb. 142,600
Weight of struck car, lb. 92,900
Struck car:
A—Car PSX-1 with friction draft gear
B—Car PSX-1 with rubber cushion draft gear
C—Conventional sliding center sill
D—Car SX-1-M with Meyer sliding sill

Fig. 8—All four cushioning devices compared at 4, 7 and 10 m.p.h. with the struck car loaded to 40 per cent of capacity.

more than the Pullman-Standard rubber cushion underframe with sliding center sill.

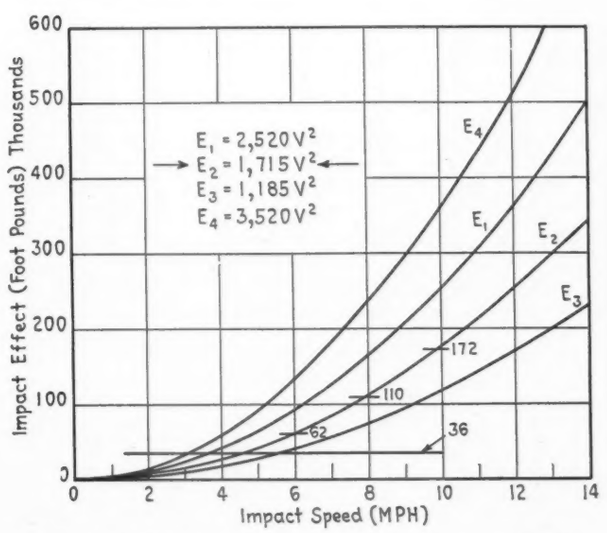
There is another way to look at these curves. If 500,000 lb. is arbitrarily used as a coupler force which will cause damage to the car structure, it will be seen that the car without draft gear reaches 500,000 lb. at 4.2 m.p.h., the car with the friction draft gear reaches 500,000 lb. at 4.9 m.p.h., the rubber draft gear car at 55 m.p.h., the conventional sliding center sill underframe at 6.2 m.p.h. and the Pullman-Standard rubber cushion underframe at 7.6 m.p.h.

Fig. 5 shows a bar graph prepared from data taken from the curves shown on Fig. 4. Three speeds are shown for comparison: 4, 7 and 10 m.p.h. Car A is equipped with friction draft gear, B with rubber cushion draft gear, C with conventional sliding sill underframe and Car D with Pullman-Standard rubber cushion underframe. This graph gives a ready comparison of the effectiveness of the different types of draft gear in reducing the force acting on the car and lading.

Fig. 6 shows some typical curves plotted from laboratory data showing the effect of impact speed on horizontal acceleration, the factor causing damage to the lading. There is a noticeable spread between the different types of draft gears. Fig. 7 gives similar information in bar graph form. At 7 m.p.h. the car body with the friction draft gear is subjected to an acceleration of 18.6 times gravity, with the rubber cushion draft gear this acceleration is reduced to 11.2 gravity and with the Pullman-Standard rubber cushion underframe the value is 5.9 gravity.

As pointed out in the discussion of fundamentals, the acceleration of a car body is not directly proportional to the coupler force. From the data just presented on force vs. impact velocity it was noted that the rubber gear had 95 per cent of the force produced by the friction draft gear and the Pullman-Standard rubber cushion underframe had 52 per cent of the force developed by the friction gear. On the other hand, with the rubber cushion draft gear the body acceleration is only 60 per cent of the friction gear acceleration and the Pullman-Standard cushioned car is only 30 per cent of the friction gear.

The values presented for a 7 m.p.h. impact speed are



Weight of struck car, lb. ..... 164,600 } E1
Weight of striking car, lb. ..... 142,000 }
Weight of struck car, lb. ..... 74,100 } E2
Weight of striking car, lb. ..... 168,600 }
Weight of struck car, lb. ..... 46,400 } E3
Weight of striking car, lb. ..... 142,000 }
Weight of struck car, lb. ..... 210,000 } E4
Weight of striking car, lb. ..... 210,000 }

Fig. 9—Impact effect at different impact speeds with four random combinations of car loading.

important since 7 m.p.h. represents the mean speed at which cars are being impacted in classification yards. It is of further interest to note that these accelerations do not change appreciably with a change in load. Fig. 8 shows a bar graph of horizontal accelerations for a 40 per cent load condition. For a friction draft gear the acceleration is 18.3 gravity as compared with 18.6 for the fully loaded condition. For the rubber gear 11.2 as compared with 11.2, for the Pullman-Standard 5 as compared to 5.9.

From these figures it can be seen that providing adequate protection for lading raises serious problems. The package designers have made progress, but it seems almost unfair to expect that they can supply adequate

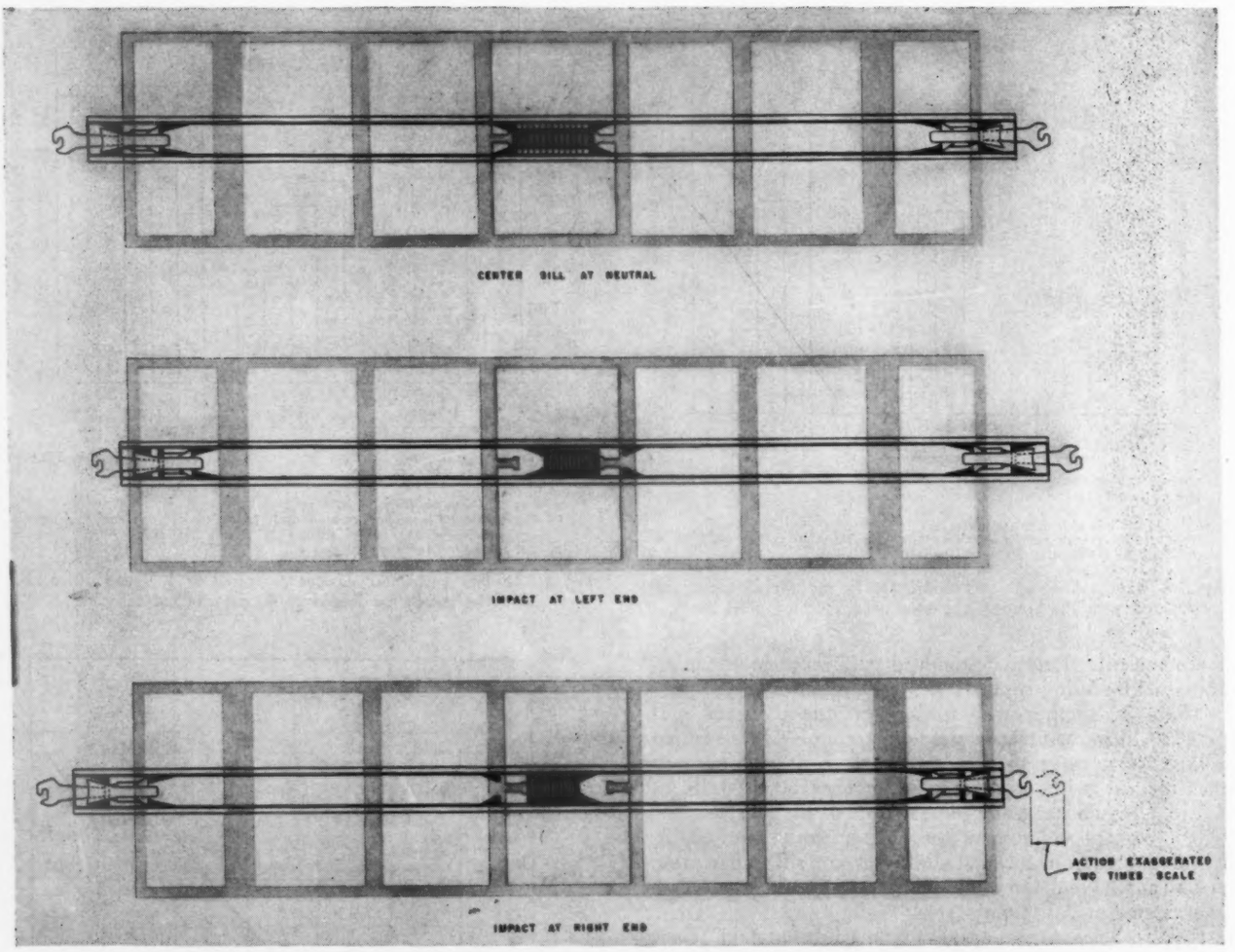


Fig. 10—The operating characteristics of the Pullman-Standard rubber cushion underframe with sliding sill

packaging for protection against the very high accelerations encountered, unless the package becomes more expensive than its contents, which means it is then economically impractical.

Fig. 9 shows curves for the impact effect vs. impact speed, impact effect being previously defined as that part of the energy which must be absorbed by the draft gear, the car structure and its lading.

From these curves it is apparent that conventional draft gears absorb only a small percentage of the energy, leaving the rest of the energy to be absorbed as best it can by the structure and lading. This absorption of energy is the principal area in which draft gear designers and car builders can contribute to the improvement of freight cars. There are of course severe limitations on what the draft gear designers can do, since the travel for draft ears today ranges from 2⅝ in. to 3¼ in. The absorption of an appreciable amount of energy with this much travel requires a very high force level which in itself may be damaging to structure and lading. If freight cars are going to be impacted at speeds in excess of 5 m.p.h., and currently approximately 80 per cent of all impacts occur above this epeed, then it becomes apparent that the car builder must make his contribution to the cushioning problem and employ the principle of the sliding center sill. By means of this principle more work can be done at reasonable force levels because of the increased length of travel available.

The PS Rubber Cushion Underframe with sliding sill represents the best of several designs of freight car cushioning devices developed and tested by Pullman-Standard over the past few years. This device, illustrated in Fig. 10, appears to be most promising, both from a standpoint of its cushioning capacity and simplicity of design. The car is arranged so that the center sill slides relative to the underframe and is connected to the car body through rubber compression pads. The total travel of the sill is approximately 7 in. under an impact speed of 13 m.p.h. with a fully loaded car.

This gear never goes solid against metal but continues to compress the rubber. In addition to the cushioning between the sliding center sill and the car body, conventional draft gears are used at each end of the center sill. This feature gives protection to the center sill itself, as well as additional cushioning to the car and its lading. Fig. 11 shows the force and cushioning capacity vs. sill travel for this type of construction. It will be noted from these curves that the cushioning capacity is in excess of 120,000 ft.-lb.

The use of the rubber cushion underframe with sliding center sill also reduces vertical accelerations of the car body. Fig. 12 shows some oscillograph curves plotted for vertical acceleration vs. time at the struck end of the car and at the end opposite the struck end. It will be noted that the maximum acceleration for the standard construction is about 138 feet per second per second, whereas for

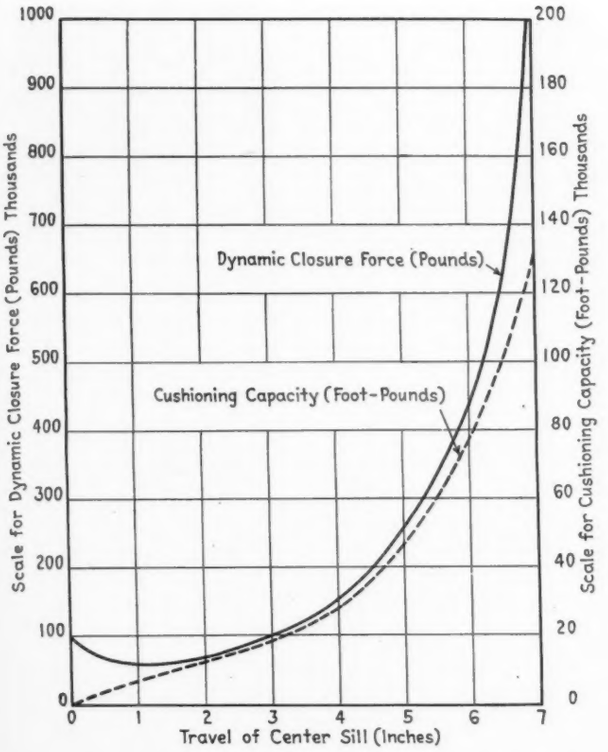

Scale for Dynamic Closure Force (Pounds) Thousands
Scale for Cushioning Capacity (Foot-Pounds) Thousands
Dynamic Closure Force (Pounds)
Cushioning Capacity (Foot-Pounds)
Travel of Center Sill (Inches)

Fig. 11—Force and cushioning capacity vs. center sill travel for the PS rubber-cushion underframe with sliding sill.

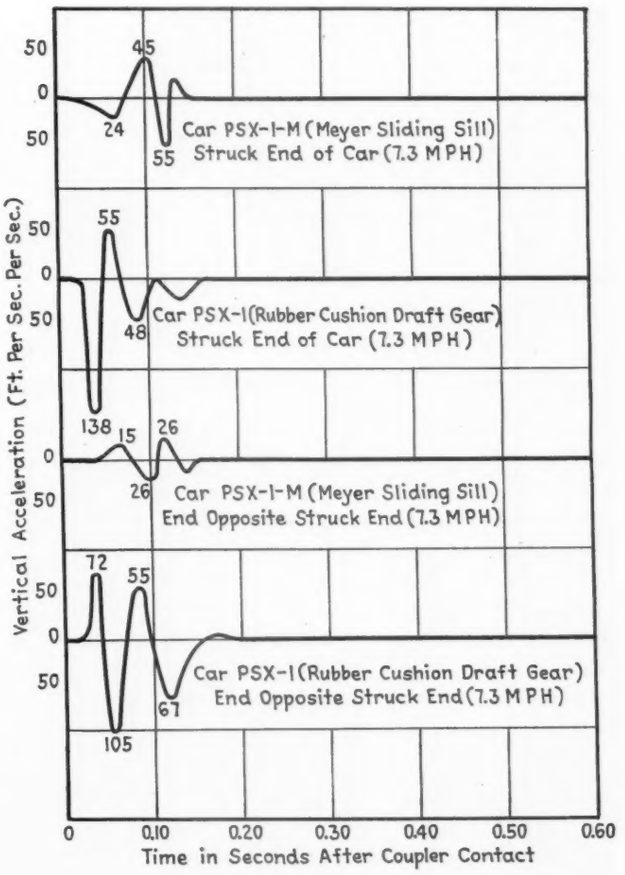

Vertical Acceleration (Ft. Per Sec. Per Sec.)
Car PSX-1-M (Meyer Sliding Sill) Struck End of Car (7.3 MPH)
Car PSX-1 (Rubber Cushion Draft Gear) Struck End of Car (7.3 MPH)
Car PSX-1-M (Meyer Sliding Sill) End Opposite Struck End (7.3 MPH)
Car PSX-1 (Rubber Cushion Draft Gear) End Opposite Struck End (7.3 MPH)
Time in Seconds After Coupler Contact

Fig. 12—Oscillograph curves of the vertical acceleration of both ends of a fully loaded struck car.

the sliding sill the maximum acceleration is 55 ft. These curves also illustrate the fact that the initial acceleration of the struck end of the car is downward whereas the acceleration on the end opposite the struck end is upward.

Railroads today are making every effort to realize higher utilization of equipment. This seems to reflect itself in higher speed operations all down the line, including impact speeds in classification yards, the mean speed according to one survey being around 7 m.p.h. As a result of these increased speeds car structures and lading are being subjected to higher forces and a requirement exists for developing better draft gears and other types of cushioning devices to protect both the car body and its contents.

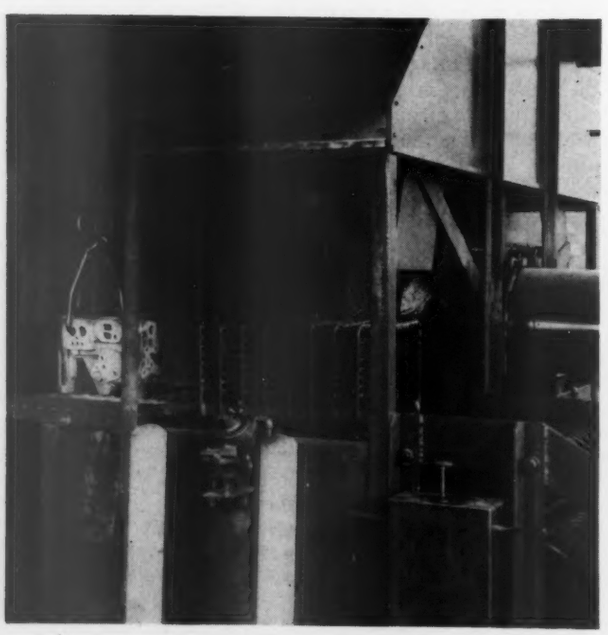
Present draft gears are entirely inadequate for the amount of energy which they are required to absorb. The rubber cushion sliding center sill is a step in the right direction towards solving this problem. As long as free slack in a train, which limits draft gear travel, is a problem which must be contended with it appears that future trends will have to be along the lines of the sliding center sill car. By this means a reasonable amount of work can be obtained at a force level which will not cause damage.

There is also the possibility that hydraulics may enter the picture again although hydraulic draft gears have been tried unsuccessfully from the day of George Westinghouse up to the present time. Hydraulics offers, theoretically at least, the advantage of maintaining a constant force level throughout any given length of travel.

Adequate horizontal cushioning appears to be the main problem facing the railroads today. Some progress has already been made toward solving this problem and within the next few years further progress can be expected. Improved draft gears used in connection with the other devices should go a long way towards improving conditions throughout the railroad industry.

Fig. 1—Machine for dip painting castings.

Air Brake Corrosion Problems



C. E. Macfarlane

Chief Chemist, Westinghouse Air Brake Co.
Wilmerding, Pa.

In many respects air brake equipment, especially that used by railroads, is unique. In the first place the air brake is safety apparatus, it must be as foolproof as it is humanly possible to make it, and that has always been the principal aim of air brake engineers.

Air brakes are unique in the manner in which they operate. In a long freight train the rear cars may be as much as 1½ miles from the locomotive, with no mechanical linkage or electrical current to connect them. Yet, the brakes can be promptly applied or released throughout the length of the train merely by changing the air pressure in the brake pipe at the engine. In each of the cars this causes the movement of precision made parts which are sensitive to pressure changes of as little as .4 pound per sq. in. This seemingly delicate equipment travels on cars and locomotives all over the North American continent,

◀ Fig. 2—Close-up of machine showing basket for holding castings.

from Canada through the 48 states to Mexico, with the attendant extremes in climate. It is exposed on the outside to rain, snow, subzero weather, hot sunshine and all kinds of industrial atmospheres and on the inside to air carrying varying amounts of moisture, oil vapors and other contaminants. It is subjected to vibration, shocks and rough handling, but at times may stand idle for weeks or months and yet must function again perfectly when called upon, without even first being inspected. In spite of these rather severe requirements air brake equipment does not receive any attention, such as cleaning or lubricating, oftener than six months to three years, depending on the type of equipment. It is also expected to last and to perform its duties for many years.

This equipment is of necessity made mostly of metals, and most metals are subject to corrosion unless properly protected. It follows therefore that these devices must be made of carefully selected and treated materials in order to maintain the reliability of functioning and the safety standards that are expected of them.

The essential parts of this equipment consist of various control valves which are usually made mostly of cast iron, or in some cases aluminum, and which contain parts made of brass, zinc die castings, steel and plastics; of reservoirs which may be either cast iron or steel, of brake cylinders, made of cast iron and steel, and of air compressors, also made of cast iron or aluminum and steel.

The various types of valves contain the vital moving parts that control the brake functions. The frictional properties of many of these parts are important and must remain relatively constant. From an economic and production standpoint the most practical material for the valve bodies is cast iron, or for some of the newer designs aluminum die or sand castings. It has always been the practice to treat the iron castings in some manner to reduce or retard the rusting of the internal surfaces which would otherwise take place in a short time. The oldest method was to immerse the bodies after machining in molten paraffin wax. This afforded a moderate degree of protection, but the choice of paint which could be applied to the exterior over the paraffin was limited due to the solubility of paraffin in most paint thinners which prevents complete drying.

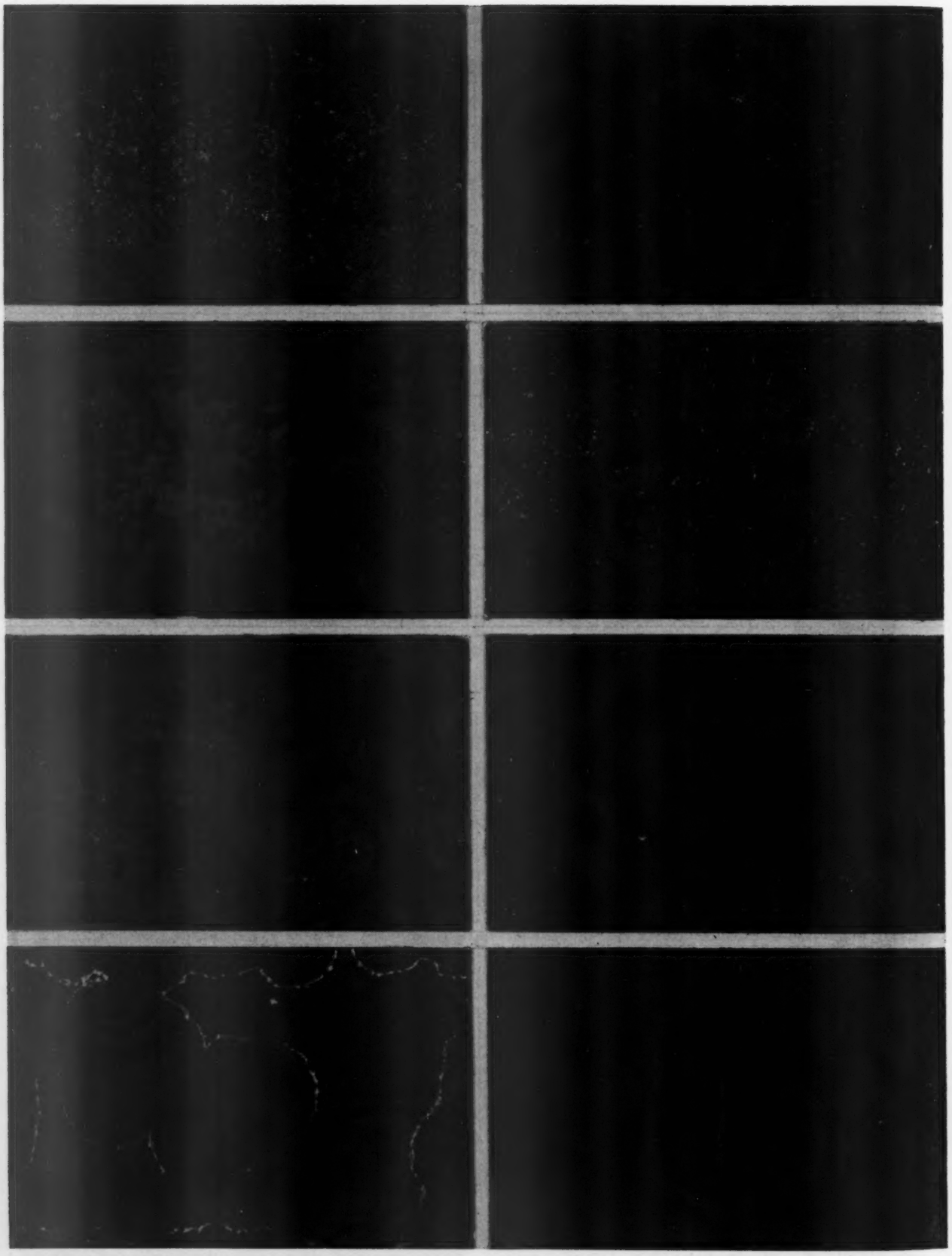
Later a large number of materials and treatments which could be applied by simple immersion was investigated for the purpose of improving both the rust resistance on the internal surfaces and the paint adherence and drying on the external surfaces. As a result of these tests a material was adopted which consisted of a harder and more insoluble wax than paraffin with the addition of some resin dissolved in an organic solvent. This treatment permitted the application of a wider range of external finishes and an aluminum paint was decided on which provides longer protection, dries more completely, acts as a better base for repainting and has a more pleasing appearance. As the brake requirements became more stringent and the functions more critical, it was desired to improve the corrosion resistance of these valve bodies still further. A paint primer, preferably applied by dipping, had been considered from time to time, but had not been adopted because it was not practical to apply paint to machined surfaces which had to be held to close tolerances. After more extensive testing, including tests on valves in actual, accelerated operation, it was decided to split the protection into two treatments, the first for unfinished surfaces, and the second for machined surfaces. The practice now in use for cast iron valve bodies and many other iron castings is to dip paint the rough castings after they are cleaned in the foundry by sand-blasting or in a molten salt. A quick drying zinc chromate-iron oxide primer is used for this purpose. This provides by far the best protection against corrosion of the internal surfaces that has been used and also has these additional advantages: it prevents rusting not only in service, but also during storage before machining, it simplifies cleaning after machining by making it easier to remove cuttings from the smoother surface, and it provides a good base for the finish paint coat which is applied to the outside of the castings. The complete removal of cuttings from the internal cores is particularly important.

The method and equipment which are used for dip painting valve bodies are rather interesting. These castings are extremely complicated cored castings and in order to cover all internal surfaces and then drain all excess primer out, it is necessary to rotate the castings through a 360-deg. circle. For this purpose our engineers designed and built several machines which resemble ferris wheels. The castings are placed in open mesh baskets and the machine is indexed to the next position, the castings moving down into the paint tank in which the paint is agitated to prevent the pigment from settling. After a controlled time interval the machine indexes again and the castings eventually are completely rotated and returned to their original loading position where they are discharged from the other end of the basket. By this means all the internal as well as the external surfaces are covered with the primer and, what is just as important, the excess is completely drained, including that from dead-end cores. At each indexing position a set of castings is discharged and a new set loaded into the empty basket. The viscosity of the primer is closely controlled and frequently checked so as to maintain the correct film thickness.

This primer remains on all unmachined surfaces but is removed during the machining of the finished surfaces. These surfaces are protected by a second dipping operation in the wax-resin solution previously referred to. This material is applied by the same type of machine as that used for the primer. It leaves a thin, smooth coat which does not cause any difficulty in obtaining air tight gasket joints on these surfaces.

Moving parts in the valves, such as pistons and slide valves, and the parts with which they are in contact, such as cylinder liners or bushings, are made of brass, molded phenolic plastic or sometimes stainless steel. It is particularly important to prevent corrosion of brass pistons with closely fitting bronze piston rings, as it takes relatively little corrosion in the ring groove to cause a ring to stick, and a stuck ring usually means faulty brake operation. A great deal of study has been devoted to this subject throughout the years. Brass containing 5 per cent or more of lead is much easier to machine than lead free brass, but it also corrodes more in moist air, forming a white deposit on the surface. We have compromised by using brass containing 2 per cent lead which reduces corrosion to a minimum, but is not too tough to machine. In addition the pistons and rings are soaked in a mixture of light oil and mineral spirits before assembly which further improves corrosion resistance.

In recent years we encountered more frequent cases of ring sticking due to corrosion of the pistons and rings in passenger brake equipment. This occurred particularly in certain locations or on certain roads. Examination of the pistons showed that in every case drops of water were present along with the oil in the ring grooves, also that the oil did not consist of the triple valve oil alone, but had been contaminated with other oil. It was also found



Eight steel panels after five years' outdoor exposure. The left hand group above are all carbon steel, the right hand group, alloy steel. The right- and left hand-panels, from top to bottom of page are, respectively: plain bars with no coating; with petrolatum coating; with Japan A coating and, bottom pair, with Japan B coating.

that more than average amounts of water were passing through the brake pipe in these trains. We then checked the condensed water drained from the reservoirs and the used compressor crankcase oil and found a distinct acid condition in both, enough to cause corrosion of brass. This corrosion was taking place because of excessive amounts of contaminated water and oil passing through the brake pipe and into the valves due to insufficient cooling of the compressed air. Every effort was made to have this condition corrected at the source, but this could not be completely accomplished and it was necessary to take other steps to prevent the corrosion in the ring grooves. It was possible to reproduce the ring sticking in laboratory tests by placing a few drops of the acidic reservoir drainings in the ring grooves of brass pistons, along with the oil and letting the pistons and rings stand for several days. Once every day the pistons were immersed in tap water for several minutes and every day a test was made to determine whether or not the ring was stuck. This accelerated treatment produced stuck rings in six days when pistons containing 6 per cent lead were used lubricated with standard triple valve oil, which is a straight mineral oil of SAE 20 viscosity. A number of different brass and bronze compositions were tried out for the pistons and several types of lubricants were used in these tests, including dry lubricants. With a combination of a 2 per cent lead brass piston and a soap thickened oil as a lubricant in the ring groove, the time required to produce enough corrosion products to cause ring sticking was extended to about 30 days. The new oil has the advantage of better adherence to metal and greater water repellency and thus is effective in retarding corrosion. The laboratory results were confirmed in additional tests which were conducted in complete valves operated with air, using the same piston materials and lubricants. In these tests it took a longer time to obtain ring sticking, and with the best combination of materials the test was finally discontinued without obtaining sticking. The low lead brass is now standard and the special oil is on service test, and according to reports received so far this trouble appears to have been overcome.

Quite a number of small steel springs are used in the valves, and again rusting must be avoided. Many years ago they were nickel plated, but that was in the days when nickel plating practices were not as good as they are today. Pin holes in the plating caused rusting and resulted in short life of the springs, especially if the equipment was exposed for any length of time to corrosive tunnel atmospheres. A thorough investigation of various plated coatings was undertaken and a change to cadmium was made with very satisfactory results. During periods of cadmium shortage it has been necessary to use zinc plating, with a dichromate finish, but we still prefer cadmium. Some of the smaller springs are made of stainless steel.

In addition to these metals aluminum alloys, mostly in the form of castings, and zinc die castings are used in many of the valves. These metals also form objectionable corrosion products when attacked by moist air unless they are protected in some manner. We have found that treatments in a sodium carbonate-potassium dichromate solution for aluminum, and a phosphate solution for zinc, provide both corrosion protection for the internal surfaces and better paint adherence for the external surfaces. Some difficulty has been encountered with corrosion of zinc die castings because of brine drippings on refrigerator cars. This could be prevented or reduced by a better external finish. But due to the interchange of valve portions from one car to another it would not be economical to apply a considerably more expensive finish to all valves to protect the relatively few which are subjected to brine.

Reservoirs for storing compressed air on locomotives, passenger cars and some freight cars are made of steel. These pressure vessels which are designed for a life of many years, are exposed to corrosive conditions both on the outside and the inside. To avoid excessive weight the thickness of steel required for each size of reservoir is carefully calculated and the necessary factor of safety and allowance for corrosion added. Our standard protection for main reservoirs for locomotives made of carbon steel consists of two coats of baked black Japan on the inside and outside. Up until about 5 years ago the Japan we used would not resist hot alkali and the railroads were warned not to use alkaline cleaning solutions to remove oil from the inside of reservoirs.

In spite of the best intentions this sometimes happened and after several such cleaning operations the Japan was stripped off and was not replaced, which eventually resulted in trouble. In response to demands for an alkali resistant protection a large number of coatings of different types, including the newer synthetics, were tested in the laboratory. One paint manufacturer came up with a Japan which effectively resists a boiling 4 oz. per gallon sodium hydroxide solution for 36 hours. This is the material which is now used on reservoirs.

Other reservoirs in less severe service are coated on the inside with an inhibited petrolatum type of material and on the outside with black paint. The inside coating has a melting point of 155 deg. F. and is therefore not used where the reservoirs are exposed to heat.

When the low alloy high tensile sheet steels containing copper, nickel or chromium became available, they were thoroughly investigated for use in reservoirs. It was soon found that these steels could not be successfully used without internal protective coatings, as the rate of corrosion in moist air is not sufficiently slower than that of carbon steel to offset the omission of the protective coating. However, laboratory and outdoor exposure tests of panels of plain carbon and low alloy high tensile steels which have been conducted for several years have demonstrated the value of the low alloy steels when they are used in combination with protective coatings. Fig. 3 shows the appearance of these panels after about 5 years outdoor exposure in the industrial atmosphere of Western Penna. It is obvious that the effective life of the low alloy steel with a given protective coating is much longer than the life of plain carbon steel with the same protective coating. While the rate of moisture penetration through the coating is undoubtedly the same in both cases it is probable that the type of oxide formed on the plain carbon steel has a tendency to lift the coating and permit additional corrosion to take place whereas the oxide on the low alloy steel has less volume and permits the protective coating to retain its effectiveness to a greater degree. We believe that the real value of the low alloy steels lies in their application in conjunction with a protective coating, and it is in this manner that we are utilizing them in air brake reservoirs. Due to their better corrosion resistance and higher strength it is possible to use a lighter gage sheet and therefore save weight.

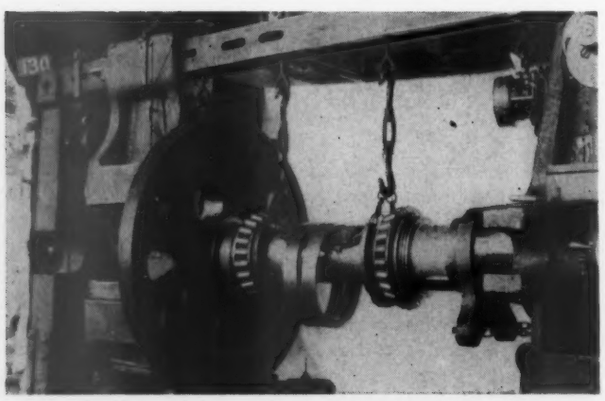
Brake cylinders are more rugged devices than the control valves, but they are often stored outdoors for some length of time and it is difficult to prevent water from entering them. Rusting of the cast iron cylinder walls and the steel hollow rods should be prevented to insure proper functioning of the cylinder and long life of its parts. The grease applied to the cylinder walls for lubrication is sufficient to protect them. Formerly the other cast iron parts were left unprotected and the steel parts were

greased or oiled. According to present standards these treatments did not produce entirely satisfactory results, and several series of tests were made with a view toward improving this condition. These tests included laboratory water spray tests and both still and operating outdoor exposure tests of brake cylinders. The materials tested for the various parts included paints, primers, lacquers, oils, waxes and several proprietary rust preventives. As a result of these tests the pistons, pressure and non-pressure heads are now painted with a primer and the springs and hollow rods are given a wax treatment.

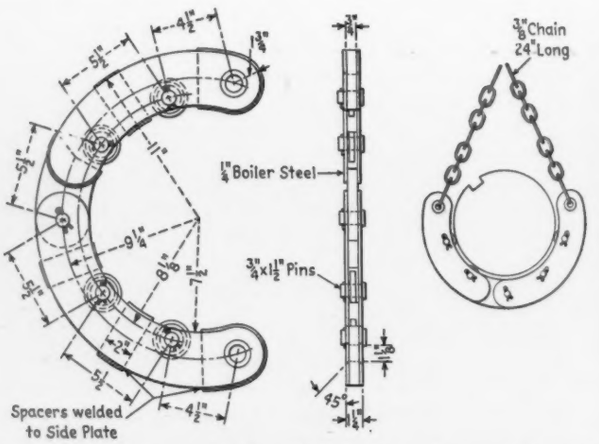
Air compressors constitute another important part of air brake equipment. Most of the internal surfaces are bathed in oil, so that corrosion is not much of a problem. Nevertheless, many of these parts are painted with a primer because it makes cleaning after machining more efficient. However some parts, such as valves, valve springs, seats and cages, are subject to troublesome corrosion from condensed moisture unless proper precautions are taken. This corrosion is most likely to take place after assembly and testing of the compressors, while they are in storage, but also on parts before assembly. The valves and valve springs are made of stainless steel. Corrosion of the other parts before assembly can be prevented by dipping in a thin petroleum product which will mix with the lubricating oil used during the compressor test. Corrosion during the later stages is more difficult to counteract. We have found that the most effective method is to drop some oil containing corrosion inhibitors into the air intake during the last stage of the running test or to pour some of this oil into the valve chambers immediately after conclusion of the test.

In our corrosion investigations we have found various types of tests useful. We generally start with accelerated laboratory tests which may consist of water spray tests or immersion tests, judging the results by appearance, weight loss or sometimes tensile tests. We prefer the water spray over the salt spray test, as we believe that it more nearly represents the service conditions that are encountered. Outdoor exposure tests on panels, actual parts or complete devices usually follow the preliminary laboratory tests, but whenever possible the final appraisal is based on an outdoor operating test of the equipment or on actual service experience. In this respect the co-operation of the railroads has been very helpful.

Over the years the operating requirements of air brake equipment have become increasingly severe and at the same time there has been a demand to lengthen the time between cleaning and repair operations. Hence, a continually greater need to prevent corrosion and keep the equipment clean has been felt. Fortunately there have also been favorable developments in materials, both base materials and protective coatings. It is our aim to take advantage of this progress and to apply the results whenever it is feasible, in order to keep pace with the ever increasing demands.



A pair of roller-type slings used to support driving axles at wheel press prior to application of the driving wheel



Details of roller-type axle sling which facilitates key way alinement preparatory to pressing on driving wheels

Roller-Type Axle Sling

The roller-type sling, illustrated, is used to hold driving axles at the wheel press and permit easy rotation until key ways are in alinement prior to pressing on the driving wheels. This sling consists of two pairs of side plates, separated 3/4 in. by suitable spacers and joined by a hinged connection at the center to adapt the sling to axles of different size. The sling carries four 2½-in. rollers supported on 3/4-in. by 1½-in. pins which extend through the side plates and are held by cotters as shown in the drawing. The sling is completed by applying two short lengths of 3/8-in. chain with rings in each end for attachment to the turnbuckles and hooks and used to support the axle from the upper bar of the 600-ton press and permit necessary fine adjustments vertically for alinement with the wheel-center bore.

This is the kind of job which can be done with makeshift "bull strength," but especially-designed equipment such as the axle sling, illustrated, permit doing the work much more quickly, easily and safely. Note that the outer roller bearing races are supported on canvass at the axle center to prevent scratching or marring either, and similar care is used in all details of putting these large roller bearing assemblies in place on the locomotive driving wheels.

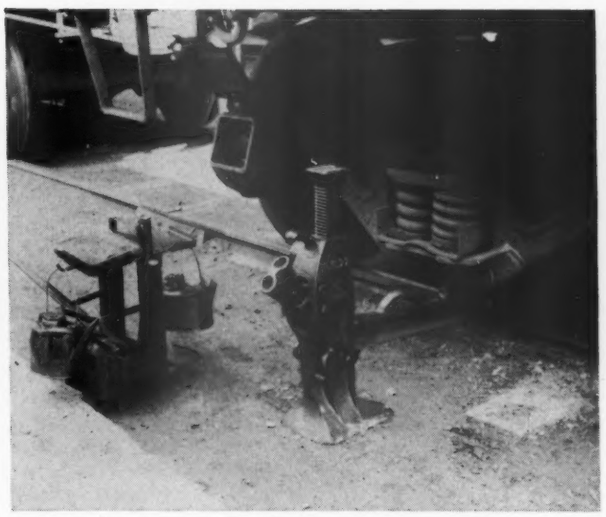
Packing Boxes and Replacing Brasses

Each side of a freight car truck need be jacked only once to repack both boxes or to replace both brasses with the method used by the Chesapeake & Ohio at Saginaw, Mich. The method employs a 15-ton jack and a section of rail 3 in. high and 29 in. long blocked as shown in the illustration.

Both sides of the truck are jacked up together to avoid any binding of the truck sides. The end of the rail away from the jack is the fulcrum, and the lifting force is applied to the side frame at an intermediate point along the length of the rail a short distance inside of the fulcrum point. In this way a high leverage ratio is attained for smooth easy raising. Different size blocks for transmitting the force are used between the rail and the bottom of the side frame to accommodate different designs of side frames.

The rail has a ½-in. hole in the bottom of the jack end. This mates with a short length of rod welded to the toe of the jack and prevents slippage. The rail is carried by the handle on top, which is made of 1-in. rod.

The small stand at the left of the jack in the picture carries essential supplies. The top holds the wedge on the right and the brass on the left, the latter having a wood lining to protect the brass. The can on the left contains car oil, that on the right a mixture of car oil and graphite to lubricate the top of the wedge. The tongs to remove the wedge and brass are offset to go around the collar. Other necessary tools frequently used, such as a hammer, a chisel to clean up the brasses, gage, etc., are also carried on the stand.



How to change brasses or repack both boxes while only jacking up the side of the truck once

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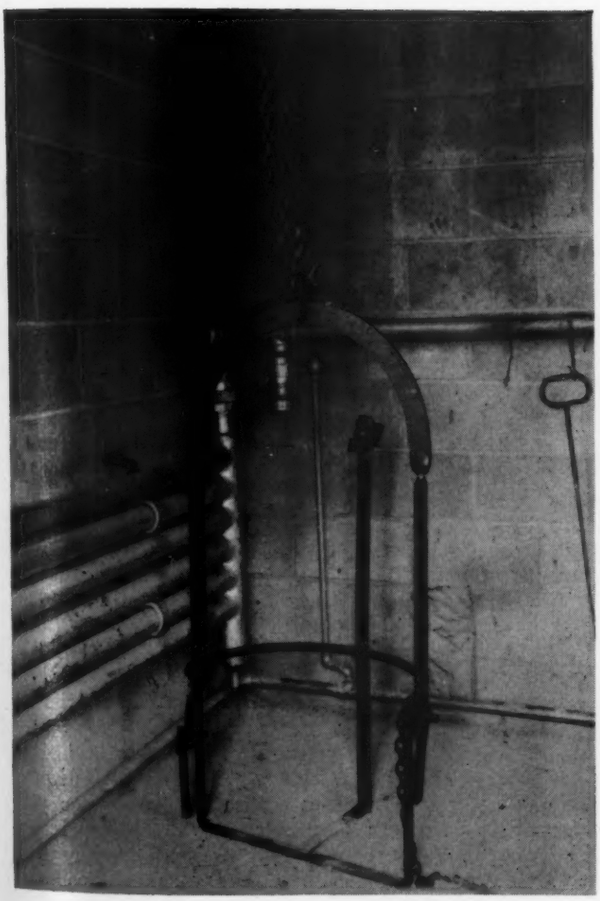


Easy Way To Handle Oil Drums

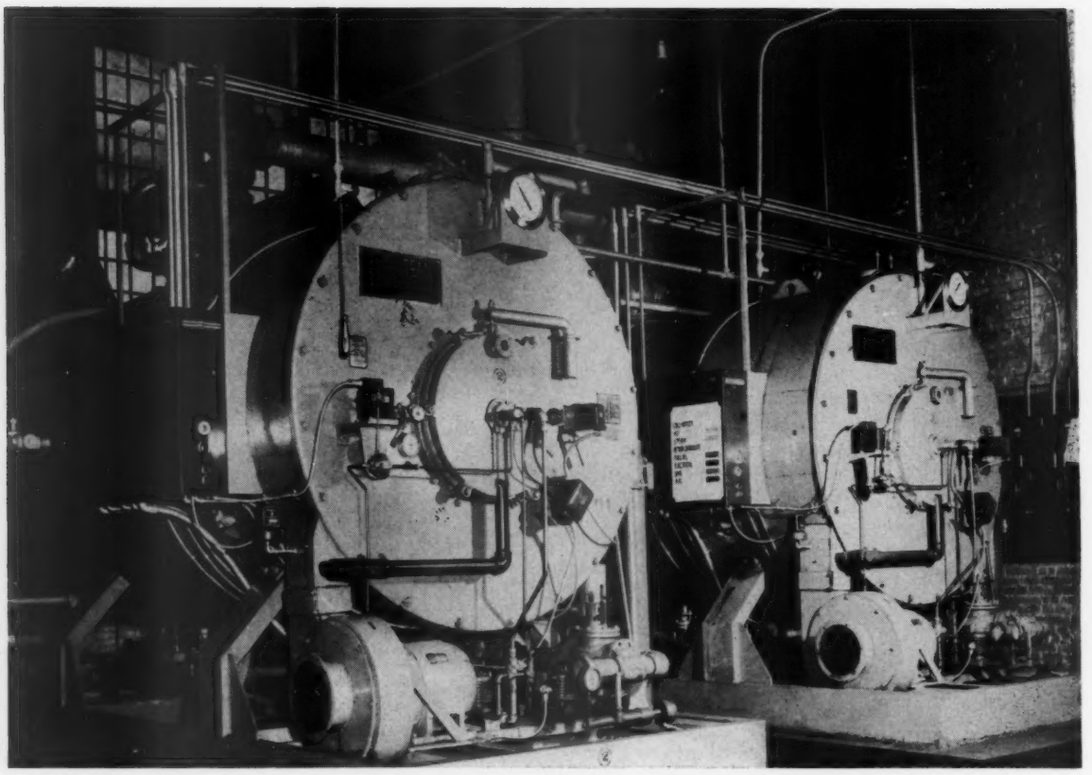
With a barrel lifter used at the Grand Rapids shops, Pere Marquette District of the Chesapeake & Ohio, drums of oil are lifted and emptied far more safely and easily than by hand. The drum is tilted sufficiently to lift it onto the base of the lifter, where it is secured by the chain. A short channel section on the near side of the rear upright member holds the drum securely along the top flange.

The lifter is divided functionally into two sections. The top, horseshoe-shaped half extends down to about half-way between the two pins and the floor. The lower half comprises the base, the semi-circular mid-height support for the drum, and the rear upright. This lower half pivots about the two pins which are located about a third of the way up from the floor to the top of the overall device.

The illustration shows the bottom of the lower half in the extreme forward position, which is employed for lifting and carrying the drum. This can be tilted in one direction only (toward the background) for emptying the drums. Restraint of movement in the other direction is provided by the flanged extremities of the upper half.

The upper section is made of strap iron ½ in. by 2 in. The lower half is a round rod section ⅞ in. in diameter. The rear support is ⅜ in. by 1½ in. in cross section. The two halves are welded together.

Oil drums are lifted, carried and emptied easier, and far more safely, with this device.



Two 8,625-lb.-per-hr. Amesteam generators at Louisville.

K. & I. T. Boiler Installation Saves $15,000 a Year

THE automatic boilers built by the Ames Iron Works of Oswego, N.Y., and marketed through Railroad Supply & Equipment, Inc., Scranton, Pa., have affected savings in the Louisville engine terminal of the Kentucky & Indiana Terminal. If present annual savings are continued, these boilers should pay for themselves in about three years. Each boiler has a normal rating of 250 hp. at 200 p.s.i., generating 8,625 lb. of steam per hour with a total heat output of 8,375,000 B.t.u. per hour. These boilers operate either on Bunker C oil or gas and because of their automatic features require no attendant.

The installation of the boilers and compressors was completed March 27, 1951, at a total cost of $62,492. Of this $49,899 was psent installing the two boilers, and $12,593 for the two air compressors. The net cost of the new installation to the K.&I.T. was $52,492, the saving of $10,000 being realized from the sale of the existing boilers and air compressors. The two steam-driven air compressors were sold to another railroad for $8,500 and the old boiler equipment was sold to a junk dealer for $1,500, with the dealer tearing down the old equipment, carting it away and cleaning up the room.

The principal demand for steam from the boilers is to supply heat to twelve stalls of a steam-locomotive roundhouse; a diesel house occupying six additional stalls of the roundhouse; a machine shop building approximately 50 ft. by 200 ft.; a steam-locomotive boiler shop 100 ft. square; a two-story storeroom 50 ft. by 150 ft.; an average of 35 to 40 passenger cars in the yard and four small buildings in the shop area.

In addition to heating the various buildings the steam from the boiler plant is also used for such miscellaneous purposes as supplying eight 1-in. blower lines for drafting steam locomotives, heating water for steam-locomotive boiler washing, supplying two steam jennys for washing diesel locomotives, and for heating the solution in two lye vats for cleaning air-brake materials, steam-locomotive parts, diesel-locomotive filters, etc.

The steam demand on the boilers is somewhat high because of the large distances over which it must be transmitted to supply the passenger-car storage track and the various buildings. The supply line is over 3,500 ft. long and about one-third of it is out of doors. Normally both boilers must be kept in operation during the winter, while one boiler is sufficient to meet the demand in the spring, summer and fall.

The overall savings realized with the new boilers over the old conventional type stoker-fed installation is estimated to run between $15,000 and $20,000 per year in addition to absorbing the increases in the price of fuels. Comparative costs of operating the power plant to supply steam and shop air for two identical ten-

month periods, one immediately preceeding the new boiler installation and the second immediately following it, were $47,494 for the first period and $34,312 for the second period. This saving of $13,182 is in operating cost alone for the ten-month period, or $15,818 per year.

From April 1950 to April 1951 the cost of operating the power plant was $51,216; from April 1951 to April 1952 it was $39,670, a saving of $11,546 over the last year with the old boilers and air compressors. However, future savings should amount to substantially more because the use of gas was not begun until August 20, 1951, and it had to be discontinued November 1, 1951, because of an early spell of severe cold weather. The gas is approximately one-third cheaper per B.t.u. than the Bunker C oil, and will be used in the future for about 9½ months of the year.

The principal savings from the boilers result from improved efficiency and the elimination of attendants.

Two secondary savings are, first, in per diem on coal-hauling cars, estimated at roughly $2,700 per year, and, second, the saving in storing and handling coal to protect against coal miners' strikes.

The saving in labor amounts to $9,000 to $10,000 per year, figured at the labor rate in effect prior to the installation of the new boilers. This would be increased about 15 per cent if the comparison were made using the labor rate currently in effect.

To operate the old boilers required a force of one stationary engineer at $275 per month and four stationary firemen, including one relief, at $1.33 per hour (present rate $1.51 per hour). Throughout the period of a year an average of two stationary firemen were required in addition to an engineer—three in severe cold weather; only one during the summer.

While the boilers can operate equally well from a combustion standpoint on either gas or Bunker C oil, gas is the preferred fuel because it is 15 cents cheaper per million B.t.u. than oil. However, because of insufficient capacity on the part of the public utility, the boilers are expected to be operated on gas only from March 1 to December 15. Bunker C is used during the winter months.

The cost per million B.t.u. with gas is 34.3 cents. Bunker C oil at 7½ cents per gallon runs 49.3 cents per million B.t.u. The coal used to fire the old boilers cost $6.67 per ton excluding handling and local transportation charges. With a heating value of 12,000 B.t.u. per pound, the cost per million B.t.u. with coal was 27.8 cents, but this did not include per diem charges on coal-carrying cars, cost of coal or cost of removing ashes.

Each Ames boiler has an overall length of 236¼ in., an overall width of 101¼ in. and a height to the main steam outlet of 109½ in. The weight of the boiler packed for domestic shipment is 26,800 lb., and the amount of water contained to the normal water line is 15,010 lb. The main steam outlet is 6 in. in diameter, and recommended diameter for stack 20 in. The full load firing rate with Bunker C oil is 69 gal. per hr.

The standard unit as delivered is complete and ready for installation on the boiler room floor, and ready for operation when connected to the customer's steam, water, fuel and electric lines and to the stack. The only foundation required is a level floor of sufficient thickness and capacity to carry load; no foundation bolts are needed.

Natural draft is not required for proper operation. The stack or vent need only to clear the roof top of the boiler room and any immediately adjacent building.

The boiler shell has only three passes of the combustion gases but because of the method of combustion employed, termed cyclonic, the exhaust gas temperature is held to not more than 150 deg. above the temperature of the steam in the unit. The guaranteed combined thermal efficiency is over 80 per cent.

The cyclonic method of combustion provides a gas travel through the boiler equivalent to 38 passes the length of the shell. The cyclonic combustion is achieved by introducing air tangentially from a preheating air ring in the front gas chamber of the boiler to the combustion chamber at a speed exceeding 200 m.p.h. The flame is fired into the center of the cyclone of air, allowing the rapidly rotating air stream to pick up the flame and to mix thoroughly the carbon particles of fuel with the oxygen in the air.

The positive air pressure in the combustion chamber where the fuel is fired is a minimum of 20 in. of static water pressure to aid in maintaining the cyclonic motion of combustion gases throughout the entire length of the furnace tube. The velocity of the air travel forced centrifugally creates a protective film of air between the heating surface of the furnace and the flame, thus preventing flame impingement on the heating surface and reducing the formation of carbon soot deposits.

The boiler is made so that both the water and the fire sides of the furnace and the tubes are accessible; the unit need only be off the line a short period for cleaning or inspection. The fire side is cleaned from the rear by removing a flue cover and a one-piece baffle which exposes the ends of the furnace and all tubes. Soot can be scraped toward the front and removed, without opening the front flue cover, through cleanout and inspection doors in the sides and the bottom of the front shell extension.

Room, however, must be allowed at one end of the unit for possible tube replacement. If allowed at rear, space may be used for both tube replacement and cleaning.

Internal water surfaces are accessible through five handhole openings 3½ in. by 4 in. and a manhole opening 11 in. by 15 in.

Commercially dry steam at operating pressure can be produced from a cold start in 20 to 30 minutes. An electric preheater raises the oil to proper combustion temperature when starting cold and keeps it there. This electric preheater cuts off automatically and a steam preheater takes over when the steam reaches approximately a 25-lb. pressure.

In the event of low water the unit is shut down completely and will not resume operations until the low water condition is corrected and the low-water relay button is reset manually. The electrode-type low-water cutoff which shuts down the unit in the event of low water is actuated directly by the water in the unit. If water is not sufficiently high to contact the bottom end of the electrode, the electrical contact is broken, shutting down the unit.

The pump control is also of the electrode type, and it is mounted in the water column. It comprises two electrodes spaced about 1 in. apart and connected to the feed-pump motor starter through its relay. When water leaves the end of the lower electrode, the feed pump is started automatically. It operates until water makes contact with the upper electrode, when it automatically stops.

Modulated burner operation is standard and is fully automatic. The modulating motor, fuel regulating valve and air regulating dampers are mounted on the front flue cover, while the modulating pressure control is in the panel box. The modulated burner provides fuel and air in the correct proportion to the steam demand at any point within the modulating range, which is the high-output range of operation. Below the standard modulating range the operation is on—off.

Injector and Governor Repair Room

A separate room 16½ ft. wide by 26 ft. long by 10 ft. high has been equipped for the inspection and repair of diesel engine injector nozzles and governors at the Chattanooga, Tenn., shops of the Southern. The room is equipped with test racks for injector nozzles and governors, glass storage cabinets, a work bench for injector nozzles, a power grinder and a motor-driven combination wire brush cleaner and buffer. The work bench for injector nozzles is fitted with the necessary drawers for small tools and air hoses for blowing parts dry. The combination cleaner and buffer is enclosed in a glass and sheet metal cabinet fitted with an exhaust fan to remove the dust. The same fan is also connected to two enclosed cabinets on either side of the buffer and cleaner. These cabinets contain the cleaning fluid tanks. Close visual inspection of small parts is made with a magnifying glass and fluorescent lighting.

After an injector has run its term of service it is brought into the reconditioning room and put on the pop tester. If it pops at 1,000 lb. per sq. in. or more, and if in the leakage test it drops less than 600 lb. in 50 seconds, it is merely cleaned and returned to service.

Approximately 90 per cent of the injectors, however, require a complete overhaul. These are dismantled in a special device with an opening specially shaped to fit the injector body. After dismantling, the injector parts are set in cold Turco solution for eight hours. After the eight hour soaking in the non-agitated solution, the parts are transferred to an air agitated solution of mineral spirits for an additional eight hours soaking. There are two tanks for each solution. A small basket holds all parts of one complete injector for immersion in the cleaning solution. The parts are blown off with compressed air after the mineral spirits cleaning.

The pop tester and the glass-enclosed storage cabinets on one side of the repair room.

The cleaner and buffer is served by an exhaust fan which is also connected to the cleaning fluid tanks.

Lapping operations are performed on 13 faces, and one joint is ground with an electric-motor-driven grinder with a swinging base. The lapping plates contain both medium and fine carborundum on each plate and are reconditioned each week. The check valve ball joint is ground on the motor-driven grinder. If it is in bad shape the grinding is done in two steps, using medium carborundum for the first step and fine for the second; otherwise one step with the fine compound is all that is needed.

All parts are washed with fuel oil during assembly to remove any dirt or lint and to lubricate the various parts of the injector. The check valve spring, the ring seal and filters are always renewed. After assembly the injectors are given a final pop test and a leakage test. Normally the reconditioned injectors pop between 1,500 and 1,700 lb. per sq. in. and leak from 200 to 400 lb. in 50 seconds. The injectors are stored in small metal boxes for shipment after squirting rust preventative inside. The top is pro-

tected by a thin cylinder of sheet metal, and a wooden block fits over the fuel oil connection stud to protect fuel oil openings. Air in the room is under slight pressure.

Box-Car Door Hanging Made Easy

The Grand Rapids shop forces of the Pere Marquette District of the Chesapeake & Ohio have built a light, easily moved stand which greatly simplifies the renewal of bottom-door casting pins and rollers or castings. It eliminates completely the need for horses and blocks, while securely holding the door out of the way for replacing the rollers or hangers.

The stand rests on a base made of four ⅛-in. steel plates 6 in. by 20 in. The upright is welded to these plates and to four braces ¼ in. by 1½ in. by 12 in. The bottom part of the upright is of 2-in. tubing and the top section, which telescopes into it, is of 2½-in. tubing. The horizontal member extending from the top tubing is a T-section 22 in. long. The T-section is built up from a horizontal strap 2 in. wide and a vertical strap 1½ in. wide; both ¼ in. thick. The end is shaped to fit under the door track. The stand is adjustable in height from 38½ in. to 47 in. If greater height is needed, it can be blocked up easily.

The first step in the use of this stand is to burn out a notch in the door track somewhat larger than the door roller casting as shown in Fig. 2. This allows the end of the T-section of the stand to slip under the door track, and the door roller casting to slide out and rest on the T-section. The edge of the door is pulled out as far as desired, and, while supported vertically by the T-section, is prevented from going back in by inserting the pin on the end of the chain in one of nine holes in the top of the T-section of the stand as shown in Fig. 3. The door is thus securely supported and at the same time completely out of the way for the renewal operations.

Fig. 1—General construction of the door stand showing the slot at the extreme right in the top member for slipping under the door track.

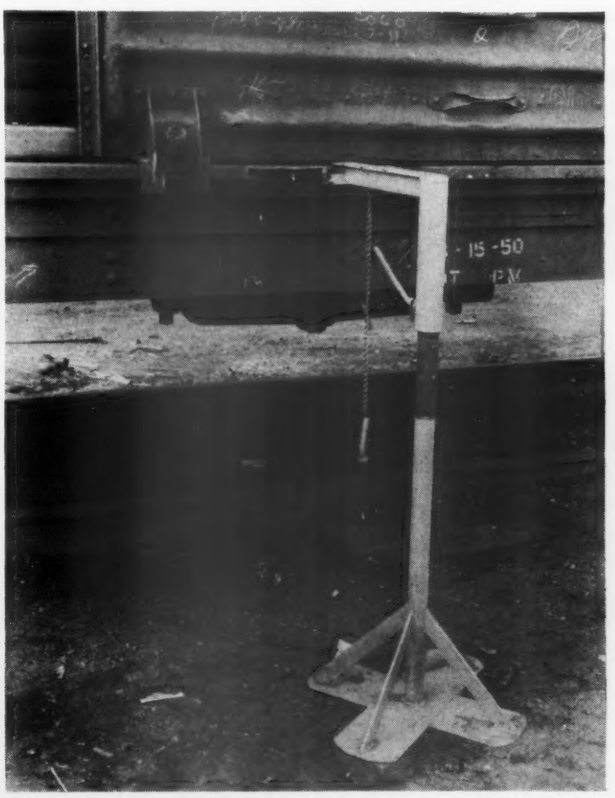


Fig. 2—With a notch larger than the door roller casting burned out of the door track, the groove on the end of the stand can be slipped under the door track and the door pulled out as shown in Fig. 3.

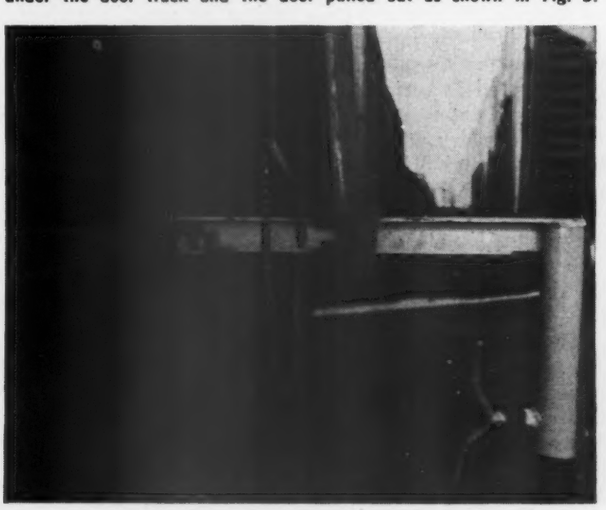
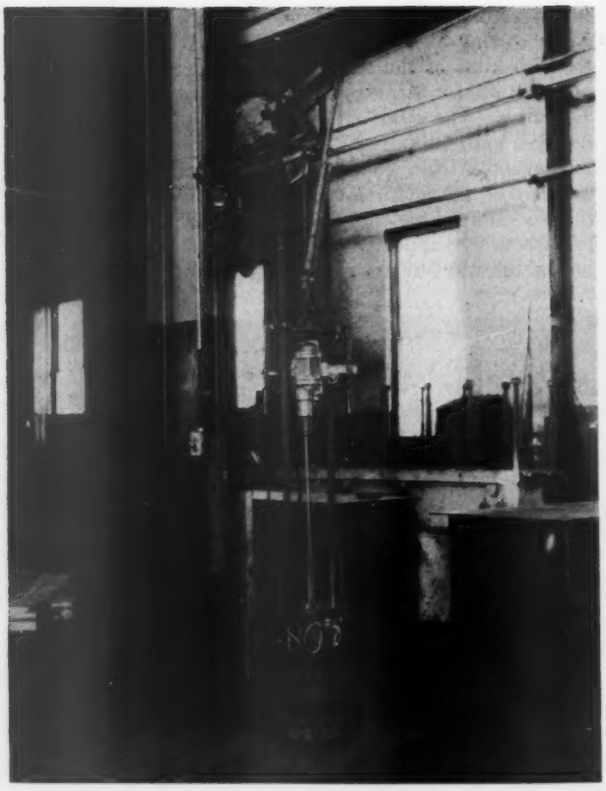
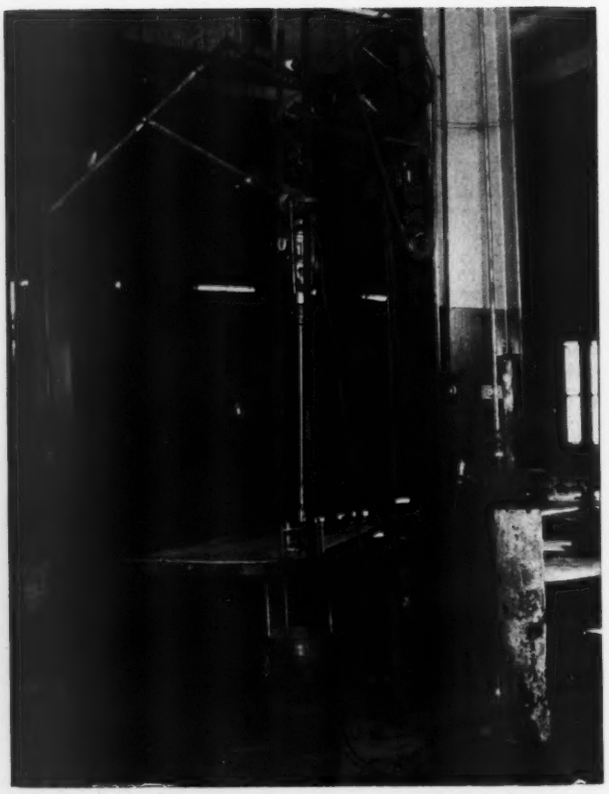


Fig. 3—How the groove in the end of the stand fits under the door track and how the pin holds the door out while the door is supported by the stand.



Honing arrangement driven by air motor through jack pump gives constant feed speed and length of stroke.



The upper lever disconnects easily by a sliding clamp and avoids complete dismantling of the set-up to inspect the tool and job.

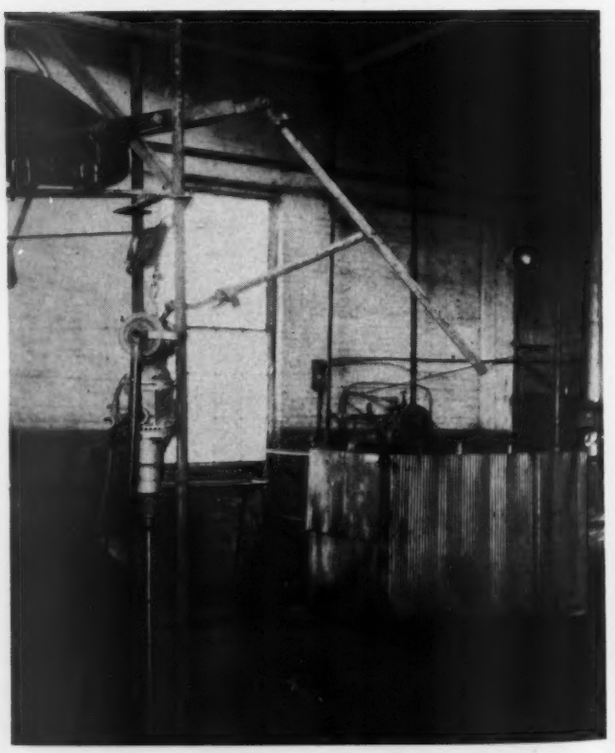
Honing Arrangement

The Peoria & Pekin Union hones Electro-Motive cylinder liners with an arrangement that includes a well jack pump for the reciprocating motion. The inclusion of the jack pump gives the hone a stroke of constant length and consistent feed speed without special attention of operator.

The jack pump is driven by an adjustable-speed air motor through two pulleys. The shaft is counterweighted so that the air motor works against an equal, but light, load on both the up and the down stroke, and therefore travels at the same speed on both strokes. The reciprocating speed is varied to suit individual conditions but averages about three double strokes per minute. All honing is done dry at a constant speed of 425 r.p.m. with the honing tool driven by an electric drill motor. Overtravel of the honing stroke is 1½ in. on each end.

For the honing operation the liner rests on a three-legged stand made of bar stock ⅝ in. by 1 in. The bottom liner seal is left in place to give added friction between the liner and the stand to prevent the liner turning while the hone is revolving.

The honing tool is guided in its vertical motion by two 1-in. pipes. The bottoms of the pipes fit over a pair of opposite liner studs, and the tops slip through two holes in the mounting bracket for the driving arrangement. The carrier for the electric drill motor rides on these two pipe guides on two wheels 1½ in. by 4½ in. The wheels are held against the guides by the reaction from the turning of the hone. A U-shaped section of strap iron 1/32 in. by ¾ in. on one side of one wheel and the opposite side of the other wheel prevents disengagement of the carrier from the guides. The drill is held to its carrier by two ⅜-in. bolts.



The top leverage system in dismantled position.

QUESTIONS AND ANSWERS

Diesel-Electric Locomotives*

Cleaning Cooler Tubes

505-Q.—If this occurs what steps should be taken? A.—A check should be made of the cooler.

506-Q.—What is the first operation for this check? A.—Drain shell side of oil through the pipe tap in the bottom shell flange. Leave this drain open.

507-Q.—What operation should follow? A. — Drain water system, blank off water inlet and outlet connections. Fill cooler full of water.

508-Q.—Should pressure be used to locate leakage? A.—Air or water pressure not to exceed 50 p.s.i., connected at the pipe located in the bottom end cover.

509-Q.—What will be the indication of leakage? A.—If any leakage exists, water will presently appear at the open drain.

510-Q.—In what other way may the tube leakage be detected? A.—By applying pressure similarly at the oil side. Tube leakage can be observed by removing end covers.

511-Q.—In case of leakage what should be done? A.—Cooler must be removed to the shop for dismantling to locate the failure.

512-Q.—What is the water capacity of the tubes? A.—Eleven gallons.

513-Q.—What is the oil capacity of the shell? A.—Sixteen gallons.

514-Q.—What type strainer is used and how does the oil flow? A.—The strainer is of the basket type, with oil entering the bottom and flowing up through a spool containing a series of staggered holes.

515-Q.—From the spool where does the oil travel? A.—From the spool oil dumps into a fine brass mesh screen enclosed by a steel perforated shell.

516-Q.—What attention should be given the strainer element? A.—It should be cleaned at each filter change or more often if necessary. In cleaning the element never use steam or a strong cleaning solution.

517-Q.—How is the diesel engine protected from low lubricating oil pressure? A.—By two switches known as OPS.1 and OPS.2.

518-Q.—How does the OPS.1 switch function? A.—The OPS.1 is set for 20 p.s.i. and returns the engine to idle when the throttle is in the 5th, 6th, 7th, or 8th notch.

519-Q.—How does the OPS.2 function? A. — The OPS.2, set for 7 p.s.i., will shut the engine down in all throttle positions.

520-Q.—How can the engine be operated at partial load in the event that lubricating oil pressure drops below 20 p.s.i. and remains above 7 p.s.i.? A.—By returning the engine control knob on the engine control panel to No. 4 position.

521-Q.—Where are these switches located on freight and passenger locomotive? A.—In the left section of the engine control panel.

522-Q.—Where are they on road switchers? A.—In the engine compartment on the left side of the rear bulkhead.

Diesel-Electric Locomotives Lubricating Oil System

523-Q.—How can the internal working parts of the switch be exposed?

A.—The switch cover is easily removed by loosening the knurled knob at the front of the case. After the cover is removed the internal working parts of the switch will be exposed.

524-Q.—Is it necessary to remove the cover when making pressure adjustments?

A.—No. Each adjustment is made by means of external adjusting screws equipped with an indicator and calibrated scale clearly visible through a window in the cover.

525-Q.—What pressure adjustments are made?

A.—Two—Range and Differential.

526-Q.—Where are the adjustment screws located?

A.—They are located on top of the case, the left one for range adjustment and the right one for differential adjustment.

527-Q.—How is the range or cut-in pressure adjusted?

A.—Raised by turning the left adjusting screw to the right and lowered by turning to the left.

528-Q.—What is meant by "differential" pressure?

A.—It is the difference between the cut-in and cut-out pressure. On locomotives with only one OPS, the differential should be set at minimum, actually no adjustment.

529-Q.—Why should these switches be checked at least monthly?

A.—To insure against maladjustment resulting from vibration or any other cause. Many railroads seal these adjustments to prevent unnecessary tinkering.

530-Q.—What should be done before changing the setting of these switches?

A.—The high pressure lubricating oil gage and oil lines should be checked first.

Cooling Water System

531-Q.—What is the arrangement insofar as the cooling water system is concerned?

A.—The engine in each locomotive has an individual cooling water system.

532-Q.—At which end does the cooling water enter the diesel engine?

A.—At the free end.

533-Q.—How is the cooling water circulated?

A.—By a centrifugal pump, gear driven from the crank shaft.

534-Q.—From the pump, where does the cooling water flow?

A.—To right and left bank headers to supply water to both banks of cylinders.

* This series of questions and answers relate specifically to the Alco-G.E. Diesel electric locomotives.

535-Q.—Trace the flow further.

A.—Water then flows up through the space formed by the liner and the jacket, enters the cylinder heads and out through the elbows which are connected to the water outlet headers.

536-Q.—How does the cooling water then flow?

A.—Water then flows to the radiators and cab heaters.

537-Q.—How does the cooling water flow from the radiators?

A.—Cooled water from the radiators flows through the oil cooler and finally to the water pump.

538-Q.—Where is the water expansion tank located?

A.—At the highest point in the cooling system.

539-Q.—What is the expansion tank equipped with?

A.—A sight level glass, a filler connection through the roof and an overflow pipe.

540-Q.—What precautions should be taken?

A.—The engine should not be operated without water showing in the sight glass and should not be operated with the sight glass completely filled. Operating with a ¾ glass is recommended.

541-Q.—What water temperature is maintained?

A.—Water temperature of 140 to 160 deg. is maintained by thermostatically controlled shutters and fan as the water passes through the radiators.

Schedule 24 RL Air Brakes

Suggested Procedure When Pipes Are Broken

1360-Q.—Why is it necessary to drain the auxiliary reservoirs and have them open to the atmosphere?

A.—This is done to guard against the possibility of cock key leakage, resulting in a stuck brake.

1361-Q.—How may the reservoirs be drained?

A.—By removing a reservoir pipe plug or disconnecting pipes 2, 3, or 5.

Operation of the B Type Relay Valve

1362-Q.—When a brake application is made what air pressure flows to the relay valve?

A.—Air from control pipe *16*.

1363-Q.—What action results from this flow of air?

A.—Air from the control pipe builds up in chamber *B* on the face of the relay valve piston *17* (Fig. 27) moving the piston and attached piston lever *19* upward,

1364-Q.—Is there any resistance to the upward movement of the piston?

A.—Application valve spring *38* resists the first movement of the piston.

1365-Q.—What results from the resistance to this movement?

A.—The resistance of the spring causes lever *19* to fulcrum at the right end, between application valve stem *34* and adjusting screw *24*.

1366-Q.—With the lever thus fulcrumed at the right end, what happens?

A.—The left end of the piston lever moves upward.

1367-Q.—What action takes place with the upward movement of the left end?

A.—As the left end of the lever moves upward, it lifts exhaust valve stem *26*, seating exhaust valve *27* on its seat on the piston *29* and moving the latter against its bushing seat.

1368-Q.—When the piston moves against its seat, how is the movement of the left end of lever 19 affected.

A.—As the piston seats, it limits the upward travel of the lever at the left end.

1369-Q.—What communication is broken off with the closing movement of the exhaust valve and piston?

A.—Connection between the brake cylinder (chamber A) and the exhaust passage (EX.) is closed off.

1370-Q.—If the upward travel of the left end of the lever is stopped, does lever movement cease?

A.—No. The lever is now fulcrumed at the left end and as piston movement continues upward, the right end of the lever lifts the application valve stem *34*, unseating pilot application valve *37*.

1371-Q.—What is accomplished by the unseating of pilot valve?

A.—Main reservoir pressure above the application piston flows into chamber *A* and the brake cylinder faster than the rate of supply permitted by choke *12*.

1372-Q.—What does reduction of pressure above the application piston bring about?

A.—Main reservoir pressure underneath then lifts the piston, permitting main reservoir flow to the brake cylinders.

1373-Q.—What advantage is gained by the use of pilot valve and choke 12?

A.—By reducing the force required to open the large application piston valve, the pilot valve and choke function to provide easy sensitive operation of the large application valve.

1374-Q.—How long does brake cylinder build up continue?

A.—Until pressure in chamber *A* equals that in chamber *B* on the face of the relay valve piston (control pipe pressure).

1375-Q.—What takes place when the air in both chambers is equal?

A.—Application piston and its pilot valve are returned to their seats by their respective springs and stem *34*, the right end of lever *19* and piston *17* are moved downward.

1376-Q.—What flow of air is then cut off?

A.—Main reservoir to brake cylinder.

1377-Q.—How is the exhaust valve affected during the above movement?

A.—During this movement the left end of the lever pivots between spring *25* and stem *26* and holds the exhaust valve seated.

1378-Q.—What is now the position of the relay valve?

A.—This is *Lap* position in which the relay valve maintains brake cylinder pressure against leakage.

1379-Q.—What takes place in the event that a reduction of brake cylinder pressure occurs?

A.—Any reduction of brake cylinder pressure in chamber *A* on the back of the piston, below that in chamber *B* and the control pipe, will reopen the application valve to restore brake cylinder pressure.

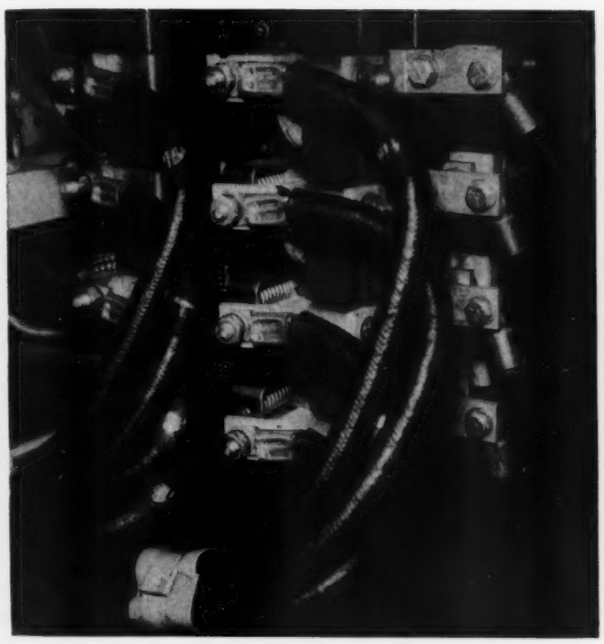


Fig. 1—Indent type terminals applied to power cables on a four-motor reverser

Fig. 2—Indent type terminals applied to control wiring. Marking sleeves pulled back to show terminals

Solderless Terminals for Locomotive Wiring

Why and How pressure-type terminals are applied and what is to be expected of them when used on diesel-electric motive power

*By R. L. Chapman**
*M. D. Henshaw**
*R. J. Nedreski**

THE shortage of tin and its allocation to uses other than for solder was one of the major reasons for the rapid growth in the use of solderless or pressure-type terminals during the past decade. Satisfaction with their performance dictated their continued use after the actual necessity no longer existed. Now the cycle of world events appears to have brought us once more to the place where the original advantage will again become important.

Locomotive Requirements

This article is written from the viewpoint of locomotive wiring practice, presenting problems in the selection and use of terminals which appear to be peculiar to a mobile unit. It necessarily covers specifically only those terminals in use in our shop and with which we are familiar, but is believed to be generally applicable to all pressure-type terminals.

Because of installation and service requirements, locomotive wiring must be flexible. Hence, it is made up of multiple strands of fine wire, usually No. 24 or smaller, as contrasted with the solid conductor or coarse stranding

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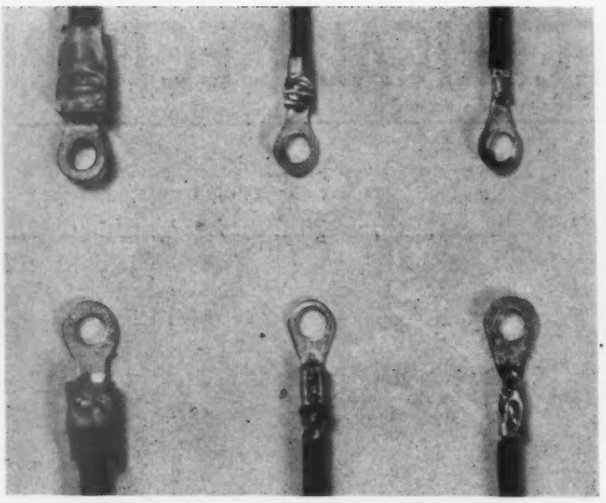


Fig. 3—Two makes of terminals in various types: (left) Pre-Insulated; (center) Insulation grip; (right) Plain

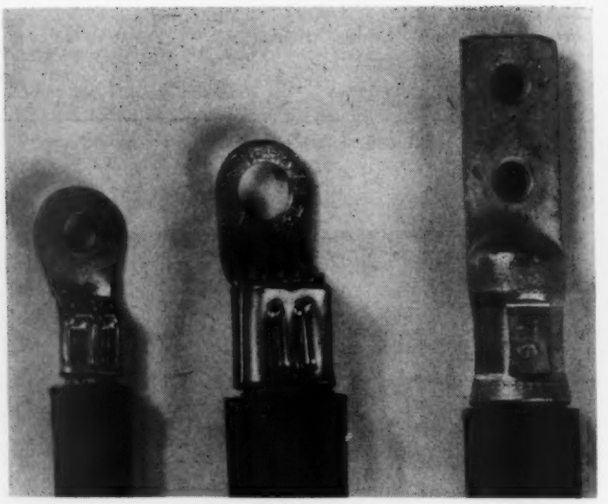


Fig. 4—Pressure terminals applied to power cables: (left) indent type on 91/24 cable; (center) indent type on 650/24 cable; (bottom) compression type on 650/24 cable

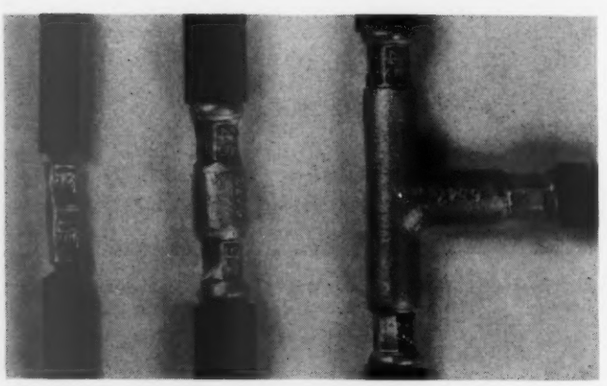


Fig. 5—Two-way and three-way connectors applied to intermediate size cable; (left) indent type two-way; (center) compression type two-way; (right) compression type three-way

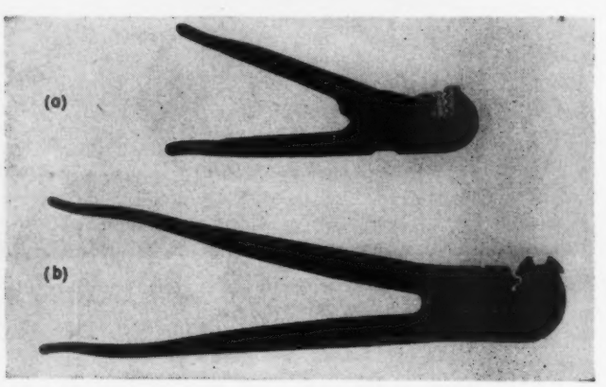


Fig. 6—Hand tools for application of indent type terminals: (a) Tool for No. 16 through No. 10 wire sizes; (b) Tool for No. 8 through No. 4 wire sizes

used industrially. These strands must be compressed to leave a minimum of voids in the barrel of a pressure type terminal. This requires that terminals be carefully sized to match the conductor with which they are to be used. Typical views of applications to locomotive wiring are shown in Figs. 1 and 2.

Another limiting feature is that space is at a premium in a locomotive. This usually requires that terminals on devices be placed as closely together as insulation considerations permit, and hence that these terminals be small and compact.

A third consideration in locomotive work is that of vibration. This tends to flex the terminals resulting in fatigue and breakage. It also tends to shake them loose, causing short circuits between terminals as well as increased contact resistance, with consequent excessive voltage drop and heating. Heating in itself, even without vibration, is a factor of major importance in locomotive power circuits since the current required during the time the locomotive is exerting its maximum tractive force will be several times the normal current demand at which the cable and its applied terminal are rated.

A terminal may fail from breakage or from poor contact, either at its bolted surface or between the inner surface of the barrel and the wire. Such a failure may, at the least, cause the locomotive to be held out of service. At the worst, it might cause a bad fire. Therefore, every effort is made to insure that all terminals are mechanically and electrically adequate to resist vibration and rough handling and to insure the continuity of the circuit.

The pressure-type terminal has met these requirements for both control and power circuits on all types of locomotives, with a minimum of trouble of any kind. Both general classifications are used, depending upon their application: (1) indent type for small and medium sizes and (2) compression type for all sizes, but particularly for large sizes for power wiring. The indent type is smaller, lighter, costs less since it is generally fabricated, and lends itself to ready application with light tools, either hand or power. The compression type is generally cast or forged, requires heavier tools with more power for its application, costs more, and is more expensive to apply.

Terminals Fall Into Three Classes

These terminals may be divided into three classifications with respect to the design of the cable end, as shown in Fig. 3: (1) plain; (2) with insulation grip; (3) pre-insulated. As the name indicates, plain terminals are uninsulated and have no provision for gripping the insulation. They are available in both indent and compression

Fig. 7—(left) Hand hydraulic tool. Fig. 8—(center and right) Pneumatic hand tool with double contact

types and in all sizes and are used where the diameter over the insulation greatly exceeds the bare wire diameter or where vibration is not severe enough to require an insulation grip. Insulation grip terminals are generally, but not necessarily, confined to the smaller sizes where vibration or the possibility of other strains dictates this extra precaution. They are also available in both indent and compression types. Preinsulated terminals are available only in the smaller sizes and have their greatest value where space is at a premium and terminals must be placed close together. Plain terminals with an insulating marking sleeve (Fig. 2) also serve admirably in the same type of applications, but do not lend themselves to color coding as readily as do the preinsulated terminals, which may be obtained in a limited range of colors.

Typical indent and compression type plain terminals applied to power leads are shown in Fig. 4.

Many forms of terminals besides the usual ring tongue are available. These include spade, flag, hook, four-way, etc., but they are used as little as possible in order to minimize inventory and storage problems. In addition to terminals, connectors, as shown in Fig. 5, are available in both indent and compression types. The special center-tongue motor lead connector, illustrated at the bottom of Fig. 4 is used where interchangeability with a former solder type connector must be maintained.

Insofar as possible, wiring is completed in locomotive sub-assemblies and in bench layouts, leaving only a minimum number of terminals to be applied at final assembly in the locomotive. All control panels are completely wired with prefabricated harnesses. A similar procedure is followed for lockers and compartments, when the quantity justifies a bench layout. Power leads are made up as a group with terminals on one end only. The other terminal is applied at final assembly after the actual length of each lead has been accurately determined.

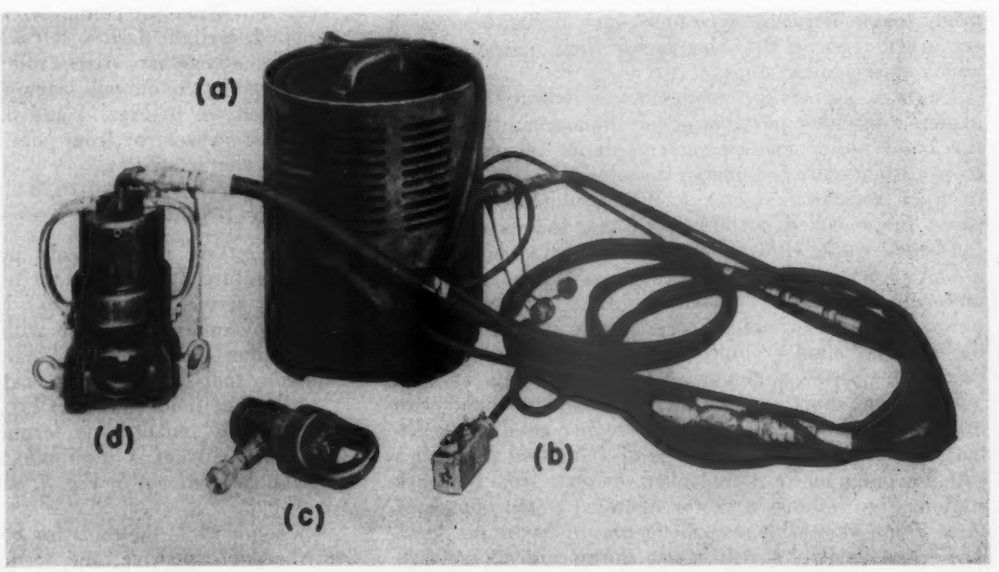


Fig. 9—Power tools for application of compression type terminals. (a) Motor-operated hydraulic pump; (b) Remote control switch; (c) Seven-ton ram; (d) 40-ton ram

Fig. 10—Electro-hydraulic tool

Tools Required

Tools for applying the terminals may be hand-operated for the smaller sizes or power operated for all sizes of terminals. The type of installation procedure largely dictates the type of tool used. Hand operated tools are of three general types: (1) plier; (2) toggle; and (3) ratchet; to furnish the increasing power required from the small to the larger size terminals. The trend in the toggle type tool for small terminals is toward an irreversible or self-locking tool, such as shown in Fig. 6-a. Once the operation is started with this tool, the motion must be completed before pressure on the terminal can be released. This eliminates the hazard of failing to close the handles completely. Such a failure is not noticed in the larger toggle or ratchet type tools, such as Fig. 6-b, which require the use of both hands for their operation, and which close against stops.

Power tools may be pneumatic or hydraulic and are available in either portable or bench-mounted types, with the latter either manual or automatic. Bench-mounted tools are generally pneumatic. Portable tools are hydraulic in order to make them completely self-contained. In some cases, the so-called portable hydraulic tool is also used for bench work. Hydraulic tools are operated either by a foot pump, as in the smaller sizes, or by an electric motor-driven pump. The latter is mandatory for large power terminals where the pressure required is beyond the range of hand or foot-operated tools. In either case, the pump portion is connected to the ram or head with one or more short sections of hydraulic hose fitted with disconnect couplings so the ram may be used some distance away from the hyraulic pump if desired. In such a case, the pump motor is controlled remotely from the work station. Fig. 9 shows a motor operated pump connected to a 40-ton ram with several lengths of hydraulic hose. The remote control switch is also shown with its connecting leads. The 7-ton ram, shown disconnected from the hose, can be used interchangeably with the 40-ton ram. from this motor-operated pump. The small ram can also be similarly connected to a foot-operated pump if desired. Another type of electro-hydraulic tool is shown in Fig. 10.

How to Spot a Badly Applied Terminal

Regardless of the type of tool used, the application does not involve a hammer blow as with a punch. Instead, it is based on a relatively slow rate of build-up of ram pressure with a proportionately slow change in shape and stress of the terminal material. It is important, therefore, that the travel of the ram be fully completed on a terminal that has been properly selected for the size of wire being used in order to insure that the terminal application is acceptable.

Very little trouble of any kind has been experienced with pressure terminals. The few instances that occurred were traceable to one of the following causes:

(1) Wire pulled too tight, causing tongue of small-size terminals to break off.

(2) Tongue not properly annealed or of faulty material, leading to same result.

(3) Travel of ram incomplete, resulting in the terminal being loose on wire.

(4) Wrong terminal size used.

(5) Use of untinned copper wire.

Cause (1) has been overcome by inspection and education. Cause (2) was corrected by the manufacturer, and has since also been materially changed for the better by a change in shape of the tongue. Cause (3) occurred mostly with plier-type tools which have been almost completely replaced by the self-locking toggle-type. The only cases of trouble due to wrong terminal size, cause (4), also involved cause (5) and, needless to say, is not recurring. Bare copper wire is no longer used, and sample specimens are made up whenever new wire sizes are involved, thus insuring that the proper size terminal is used.

The application of pressure terminals is quite suited to quality control since visual inspection is all that is necessary to assure that a proper application has been made. For terminals of the indent type, even a slight reduction in pressure shows up as a shallow indent. Improper placement of a terminal in the ram causes improper placement of the indent. The use of too large a terminal results in the barrel being squeezed out of shape with the indent not centered. When the compression-type terminal is properly applied, a slight flash is left where the two halves of the die come together. Also a die number or other symbol engraved in the die will leave a sharp pattern on the barrel as shown in Figs. 4 and 5. Defective tools, whether faulty from wear or from poor alignment, leave the same telltale characteristics.

Service Replacements

While this article deals primarily with locomotive manufacture, it is important to consider the question of field or service replacements. Here the problems are not those of an assembly line with its quantity production, but rather those of occasional installation without production tools. Several alternatives are available.

First, the tools shown in Fig. 6 are not expensive and will handle indent type terminals for all control and auxiliary wiring. A hydraulic hand tool for larger size terminals is shown in Fig. 7, and a pneumatic hand tool in Fig. 8.

Second, while the tools for compression type terminals are more expensive, the terminals themselves can be

soldered on to the cables just as well as any solder type terminal to which the user may have been accustomed.

Moreover, any damaged terminal of either type may be removed completely and replaced by a conventional solder-type terminal if no tools are available to apply another of the pressure type. This can be done without cutting off or shortening the cable by using a hacksaw to cut an X in the barrel of the terminal to be removed and spreading the points of the X to loosen the terminal on the wire.

Our experience indicates that pressure-type terminals have met all the requirements for good terminals in locomotive service. They have minimum size, adequate mechanical bond and fatigue strength, satisfactory electrical characteristics, continuing tightness and long life. The installed cost is low; and assembly, inspection and field replacement, are easy. It is to be expected that they will continue to be used in increasing numbers in all phases of locomotive wiring, both during initial manufacture and in service replacements.

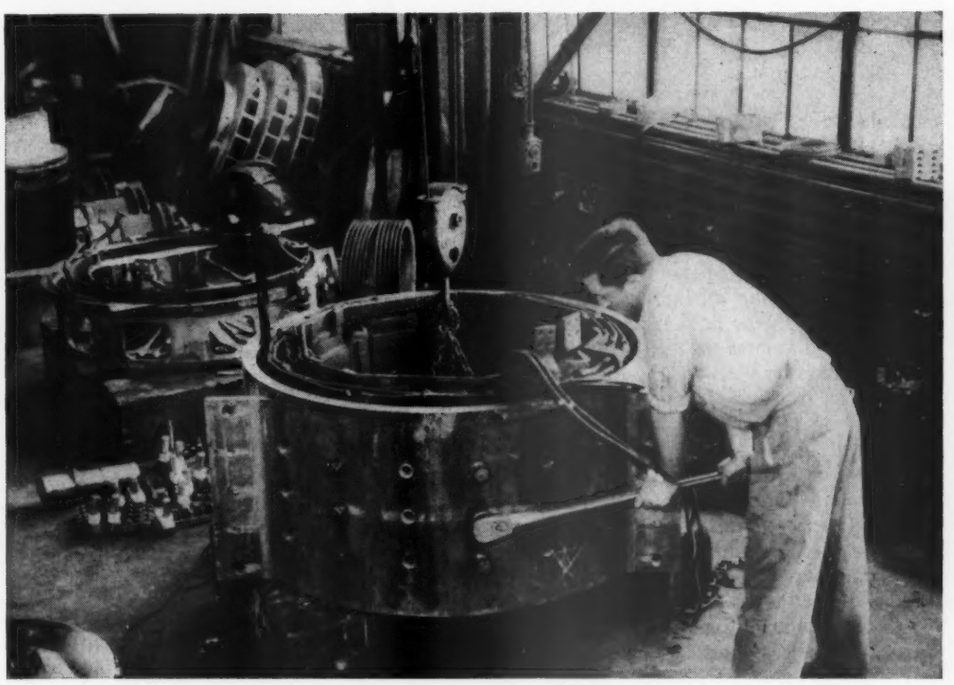


Fig. 1—With the field coils and pole pieces suspended from a hoist it is a simple matter to remove or replace the cap screws which secure the main poles and interpoles to the frame

Generator Field Overhaul

The Boston & Maine removes coil and pole assembly as a unit and uses "high hat" for applying insulating varnish

INSPECTION, cleaning, repair of field leads, replacement of coils and reinsulating of diesel locomotive generator fields has been effectively improved and simplified in the North Billerica, Mass., shops of the Boston & Maine, by the use of two simple devices.

One of these is a circular plate of ½-in. steel plate having a diameter ½ in. less than the bore of the field frame. The plate is fitted with three eye bolts for lifting. They are 120 deg. apart in a circle which is slightly smaller than the diameter of the armature.

When a generator field is to be overhauled, all parts attached to the ends of the field frame or yoke are removed and the frame is placed on its side over the circular plate.

Three lifting chains from a hoist are then hooked to the three eye bolts in the plate as shown in Fig. 1. The cap screws which hold the pole pieces are then removed and the entire field coil and pole assembly with all leads intact is removed from the frame as shown in Fig. 2. In this position, it is possible to make a thorough inspection, and it is much easier to replace a faulty coil or lead or replace damaged lead insulation than it is when the assembly is inside the frame.

After all necessary repairs have been made, the assembly is moved on the plate to the spray booth where it is thoroughly cleaned. After cleaning, with the assembly still on its side, it is lowered into the field frame and the pole piece cap screws replaced and tightened.

High Hat Reinsulation

Insulating varnish is applied to the field assembly with the aid of what the shop men have dubbed, "The High

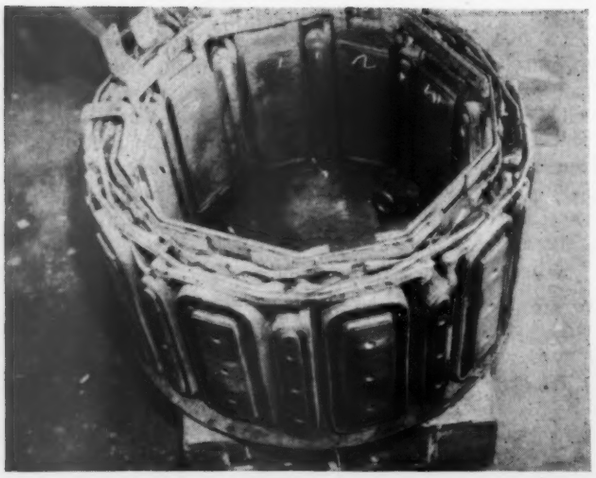


Fig. 2—Complete field coil and pole piece assembly of an EMD-D8 generator after removal from the frame. Two of the three eye bolts on the lifting plate may be seen

Hat." This is shown upside down in Fig. 3. The brim or lower flange is four in. larger in diameter than the outside of the generator field frame. The crown or cylinder is the same diameter as the generator armature. There is a neoprene gasket on the brim which is the same diameter as the field frame and there is a ring of bolt holes close to the edge of the brim.

For applying varnish, the field is heated in an oven for three hours at 250 deg. F. The hat is then placed right side up and the field frame with coils in place is lowered down over the crown until it rests on the gasket on the brim. A number of hook bolts are then hooked over the upper edge of the field frame and through the holes in the edge of the brim. Tightening the nuts on these bolts pulls the brim gasket tight against the lower edge of the field frame.

The spaces around the coils and leads, between the hat crown and the field frame are then filled with insulating varnish. Black air-drying varnish was originally used for field coils but this has been replaced with Westinghouse No. 161 Thermoset varnish used with S 110 thinner.

Fig. 3—The "high hat" (upside down) which is used to seal the frame and take the place of the armature when the frame is filled with insulating varnish

When the varnish fills the frame, it is allowed to remain until all bubbling stops. It is then drained out through a valve in the lower edge of the hat crown and the frame is again baked in the oven at 250 deg. F. for three hours.

The procedure should do much to prevent insulation breakdown and also to keep coils and pole pieces tight.

Under side of a bottom-dump ore car showing how strip heaters are applied

Strip Heaters for Ore Cars

The Atlas Car and Manufacturing Company now installs a lacework of strip heaters under the floor of its 60-ton, bottom dump ore-transfer cars as a means of keeping ore from freezing and sticking to the interior of the cars during winter months.

The cars, manufactured by the Cleveland, Ohio, firm, are used for filling the bins on blast furnace high lines. Because these bin-filling cars are generally loaded by buckets, the operation takes enough time to allow the ore to freeze in the inside of the cars during winter months. This makes dumping difficult.

Before the Atlas Company started equipping its cars with General Electric strip heaters, it was common practice to prevent freezing by putting a quantity of burning coke in the bottom of the hopper before loading it.

The heaters are clamped directly to the hopper plates in a manner which allows for expansion and contraction, and also makes individual units easy to replace. Each group of heaters is connected to a fused safety switch at the control panel to facilitate maintenance. To transfer a maximum amount of heat by conduction to the hopper plates, the heaters are clamped directly to the plates.

The heaters, moreover, are enclosed in a steel cabinet with a thermal insulation fastened to the inside of the cabinet's surface. This prevents undue heat loss from the other side of the heaters so that the loss of heat by convection to the surrounding air is also used to warm the hoppers.

To avoid unnecessary use of the heaters and to conserve power, a G.E. heavy duty industrial thermostat is adjusted to cut off power to the heaters when they are not needed. The heaters can be disconnected manually by means of a switch in the coil of the heater contactors.

DIESEL-ELECTRICS—How to Keep 'Em Rolling

11 Diesel-Electric Locomotive Excitation Systems

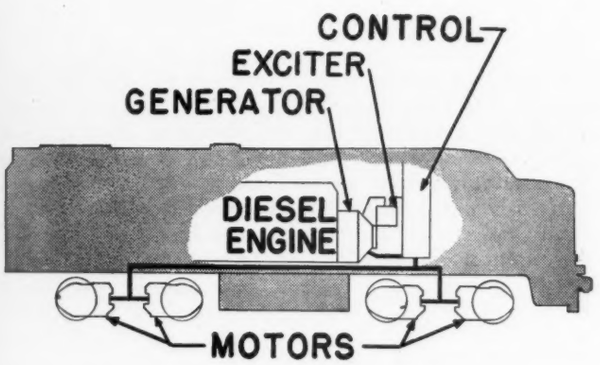


Fig. 1—Relation between main pieces of equipment on a typical diesel-electric locomotive

Up to this point, we have talked about running maintenance of motors and generators. Now we are going to switch over to the locomotive control. This is what makes the diesel engine, generator and motors work together as a smooth-running team. So, it is important to understand how control equipment works and how to care for it.

Back in the first article of this series, we described the main pieces of control apparatus, and explained the circuits generally used on diesel-electric locomotives. Now we want to talk about maintaining this control equipment. Before going into details, however, there is another important part of the general control scheme to look at. This is called the excitation system.

Fig. 1 shows how the diesel engine, main generator, exciter, control and traction motors are related. The excitation system has the job of seeing that these machines work together in the best possible manner. So you can easily see that it is a vital part of the locomotive.

What We Excite and Why

The well known proverb, "A chain is no stronger than its weakest link," is true of locomotives. For diesel-electrics it goes like this: "A locomotive is no better than its excitation system."

We have already seen, in the first article, that the voltage output of a generator depends on the speed of the armature and the amount of field excitation. The current output, on the other hand, depends on the circuit connected to the generator (usually called the "load"). In a diesel-electric locomotive, this load is the traction motors with their cables and switches. These motors should have the right voltage at all times. To get the right voltage, the current in the generator field must be varied to suit the locomotive operating conditions. This is known as excitation control.

The Locomotive's Job

To do its job on the railroad, a diesel-electric locomotive must be able to start a heavy train, bring it up to

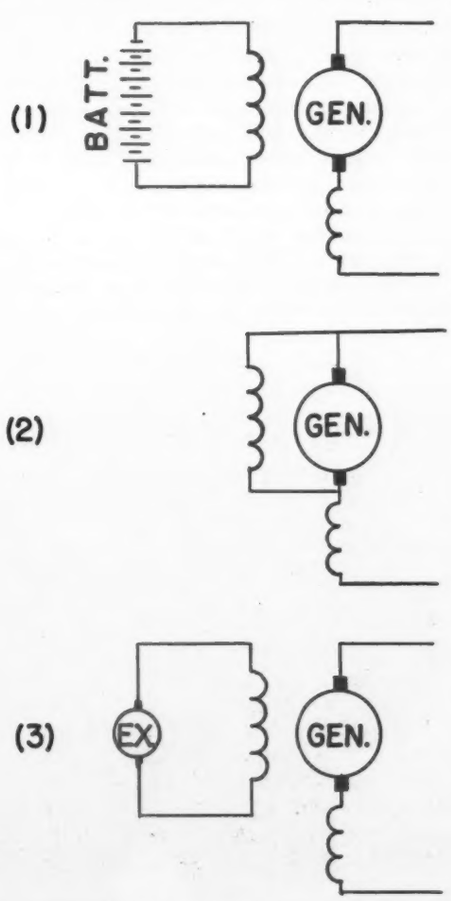


Fig. 2—Three sources of current for exciting the main generator field; (1) battery, (2) main generator armature, (3) exciter

This is the eleventh of a series of articles on the maintenance of diesel-electric equipment. This article is written by Harry R. Hill, Locomotive and Car Equipment Department, General Electric Company, Erie, Pa.

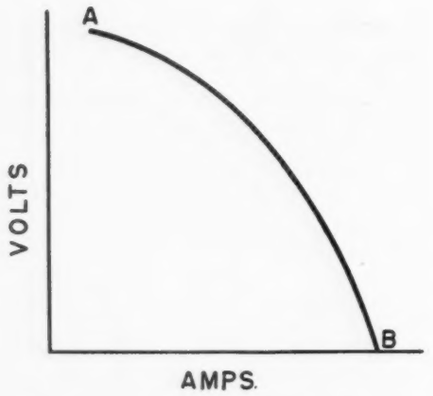


Fig. 3—How the demand of the traction motors varies over the locomotive speed range

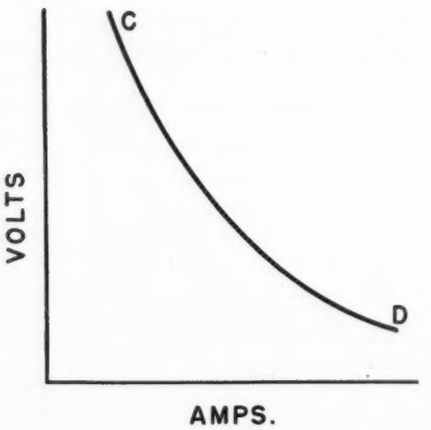


Fig. 4—The constant power output of the diesel engine shown as a volt-ampere curve

running speed, slow it down, and stop it. Just now, we are going to think about only the first two of these duties.

Starting and gaining speed require a large amount of torque, or "twist" on the wheels. You know this if you have ever tried to push your car. It took a large amount of "push" to overcome the friction of the bearings and start the car. Once it began to roll the "push" needed became less. In much the same way, the traction motors must develop a large amount of torque to start a train. Then as it speeds up, less and less torque is required.

The Job of the Excitation System

Now, how can we make the traction motors act like a man pushing a car? Think of three simple things, and you will have the answer: (1) The motor must have current flowing through it in order to develop torque. The more current the more torque. (2) Motor speed depends upon both voltage and current in the motor. (3) Power output equals torque times speed. Translated into electrical terms this is amperes times volts.

Now see how these apply to the job of starting and speeding up a train. We want to: (1) Get high starting torque. To do this, we must send a large current through the traction motors. (2) Increase the locomotive speed. To do this, we must raise the voltage of the main generator. (3) Balance power demand with engine output. To do this, we must reduce the current as the voltage is raised. (4) Reach top speed. To do this, we must raise the generator voltage to the limit.

Here is where the excitation system does its work. It controls the generator voltage, so as to do all four of these things. For this job, it must respond automatically to any movement of the throttle handle, to any change in the load on the generator, or to any combination of both.

Where Excitation Comes From

Excitation systems are of two types: internal and external. In an internal system, the main generator or exciter is built to operate as outlined above. In an external system, control apparatus outside the main generator or exciter is used to get these results. The whole problem is to properly vary the current in the field of the main generator. This current may come from (1) a storage battery; (2) the generator's own armature; (3) a small d.c. generator; or (4) a combination of the above. (See Fig. 2.)

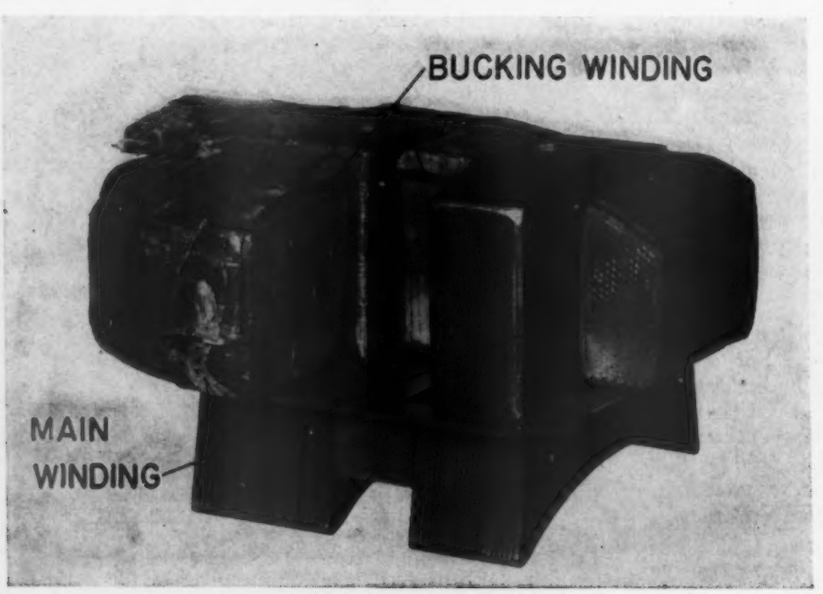


Fig. 6—The two field windings on the pole piece of a split-pole exciter

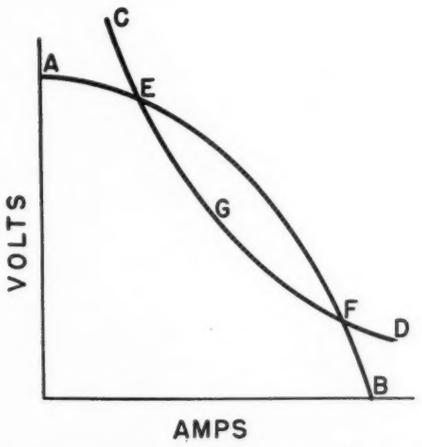


Fig. 5—Motor demand and engine output do not match except at two points in the locomotive speed range

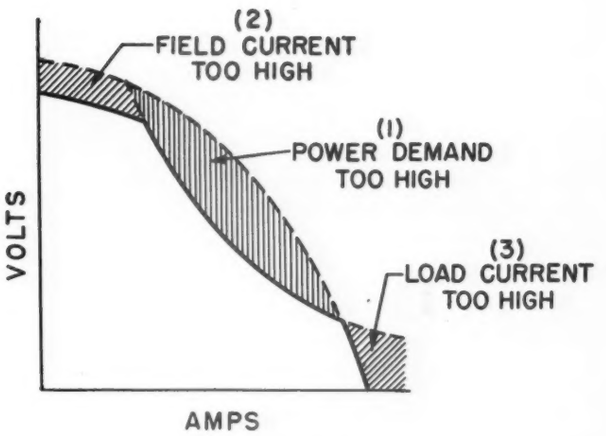


Fig. 8—Three ways in which the excitation system must control the main generator output

A good excitation system matches the diesel engine output and main generator load as closely as practical. If you think a minute, you will see why this must be done. The locomotive motors need high current when starting a train, and high voltage when running at top speed. If we draw a line showing how the current and voltage vary, it will look like Fig. 3. The power output at any point on this curve is volts times amperes at that point. This varies at different points all along the curve. On the other hand, the diesel engine has a constant power output for each throttle setting. If we draw this output curve as volts and amperes, it will look like Fig. 4. When these two curves are put together, as in Fig. 5, they do not match. It is the job of the excitation system to control the generator voltage so as to match them. This means that at all values between *E* and *F* on Fig. 5, the current flow must be just enough to give a constant engine load. This can be done in several ways.

Internal Excitation

A good example of the internal system is found in the split-pole exciter, this machine has a second winding added to its field poles as shown in Fig. 6. The current of the main generator flows through this winding. Therefore, its excitation will depend upon the main generator current output. This field bucks the action of the main field of the exciter. Hence, it will regulate the excitation of the main generator field according to the load on the generator. As a result, the voltage and current output of the main generator will follow the constant power curve (*E, G, F* on Fig. 5) rather closely.

Differential fields are sometimes used on the main generator. They are windings which buck the main fields to cut down the rise of voltage. This helps to keep the generator output more nearly constant. While this is an example of an internal excitation system, some external control equipment is always used with it.

Combined Excitation

The self-separate system is part internal and part external. It makes use of engine stalling to get the right output from the generator. At low engine speeds, a storage battery separately excites the generator field. This gives fast, positive, smooth voltages response from the main generator at starting. The same field is also connected to the generator armature. As the generator speeds up the excitation furnished by the battery is cut down. At the same time, the generator voltage is rising and its armature is furnishing more of the excitation. Finally, the battery is cut out, and the generator runs as a self-excited machine.

This method does not hold the engine load exactly constant at all times. When a point is reached where the engine is overloaded, its speed drops. This cuts down the generator voltage and also its power output. The speed continues to drop until the diesel engine output equals the generator demand. This is called the engine stalling method of balancing engine power with generator demand. It is used on some switching locomotives, but is not suited to large switchers or road locomotives.

External Excitation

Heavy switching and road locomotives must have top efficiency in using the diesel engine output. To get this,

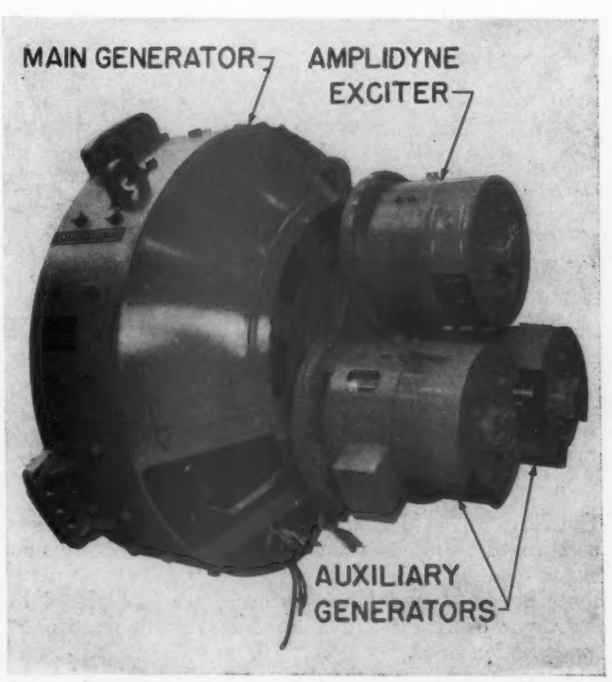


Fig. 7—Typical main generator for road-switcher and road locomotives, fitted with amplidyne exciter

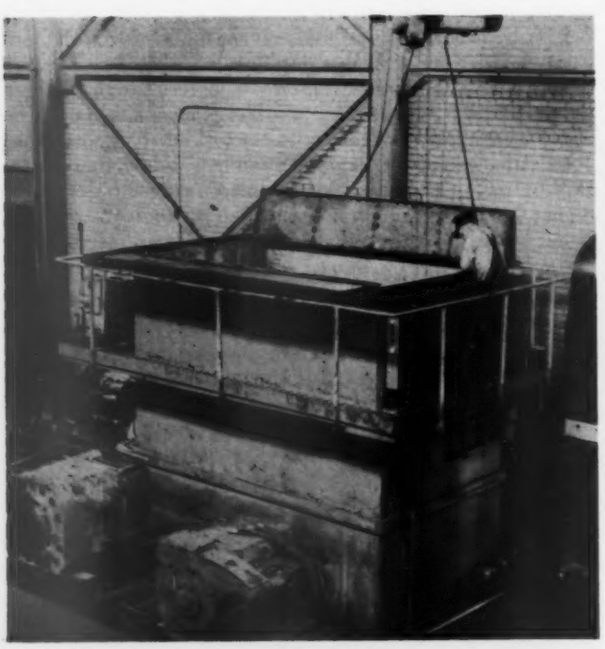
a number of external excitation systems have been designed. For best results, such a system should be controlled by small, accurate pieces of apparatus which respond quickly to any signals. This is possible only if the maximum current and required current changes in the control circuit are both small. For this reason, one such scheme uses the amplidyne generator as an exciter (see Fig. 7). This machine needs only a small current to excite its field. Also, a small change in this field current will produce a large change of voltage power output.

The amplidyne field current may be controlled by a variable resistance operated by the diesel engine governor. Another way is to use a magnetic device called a "saturable core reactor," connected in the main generator output circuit. This works like a magnetic amplifier and controls the amplidyne field current. One advantage of the reactor is that it has no moving parts. Both of these schemes match up the engine power with the generator load. They do this either by changing the speed of the diesel engine or the output of the main generator.

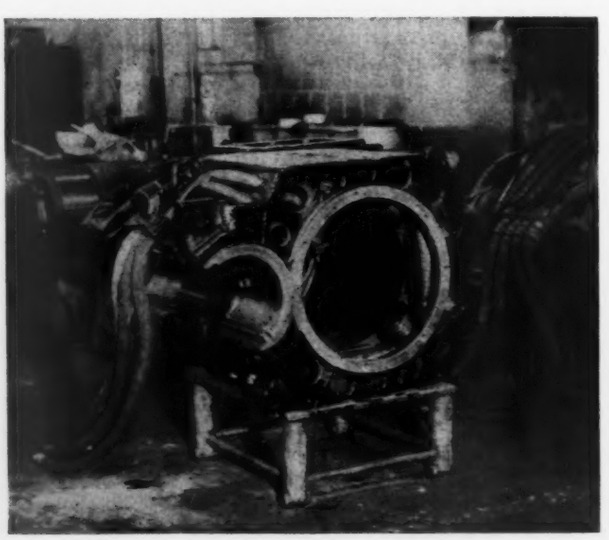
Three Jobs in One

In all except small switching locomotives, it is necessary to control the output of the main generator in three ways, as shown in Fig. 8: (1) To get full use of all available power output of the diesel engine over the widest possible range of generator volts and amperes. (2) To prevent excessive main generator voltage. (3) To prevent excessive main generator current.

We can kill all three birds with one stone by controlling the main generator excitation. This is done by varying the field current of the main generator. In theory, the engineer could do this with a hand-operated rheostat. Of course, such a scheme would not be practical in locomotive operation. The adjustment must be automatic. To get this, we use one of the excitation systems described in this article. These form a most important part of locomotive control. You must have clear understanding of their purpose and how they operate in order to properly maintain the control circuits and equipment.



The vapor degreaser stands on the shop floor and is served by an electrically-operated jib hoist



Completed field frame after impregnation and baking with masking compound removed insulation surfaces sprayed with Glyptol and motor-lead hose replaced

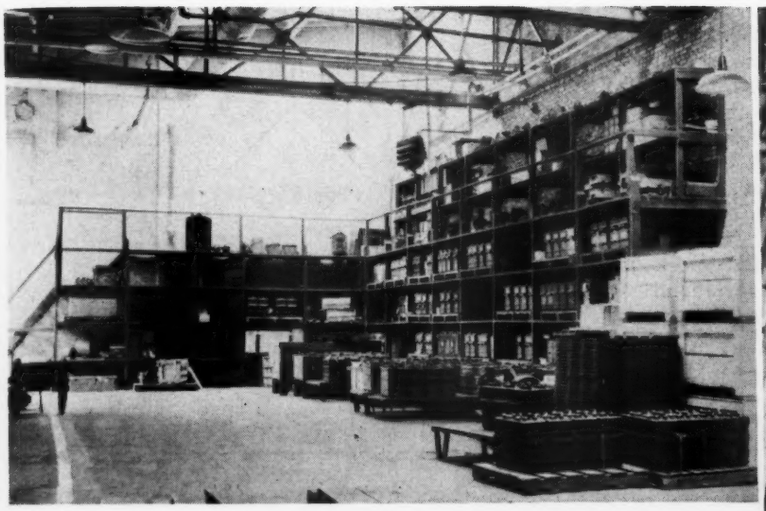
Erie Uses Impregnator For Traction Motor Fields

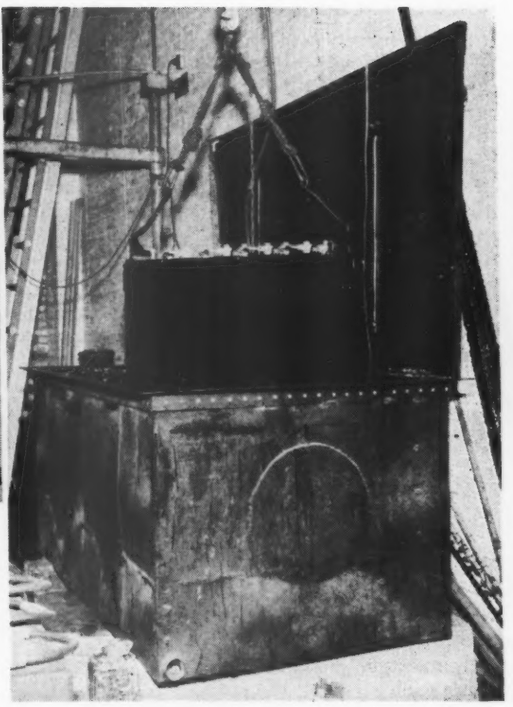
The Erie, at its Marion, Ohio, shop, is now making a practice of using its vacuum impregnator for traction motor field coils. The motor frames, with coils in place and with motor-lead hoses removed, are first placed in the vapor degreaser and allowed to remain there until condensation stops.

After removal from the degreaser, all metal and insulation surfaces are cleaned in a corn cob blast cleaner. Then all machine-finished surfaces, such as suspension-bearing and armature-bearing housing fits, are masked with masking compound. This is painted on with a brush. It dries to a rubber-like consistency, and when it has fulfilled its usefulness, it may be peeled from the surfaces to which it was applied.

With the masking compound in place, the frame is heated in an oven at 240 deg. F. for 10 hours. It is then placed in the impregnator under a vacuum of 28 in. for 20 minutes, after which the varnish is gradually admitted to the impregnator until it reaches the desired level. A pressure of 20 lb. is then applied for one hour.

The frame is then removed from the impregnator and the masking compound removed. After this, the frame is replaced in the oven and baked at 300 deg. F. for 20 hours. The final operation consists of removing the frame from the oven, and spray painting the insulation surfaces with Glyptol varnish. Results obtained by this procedure have been highly satisfactory.



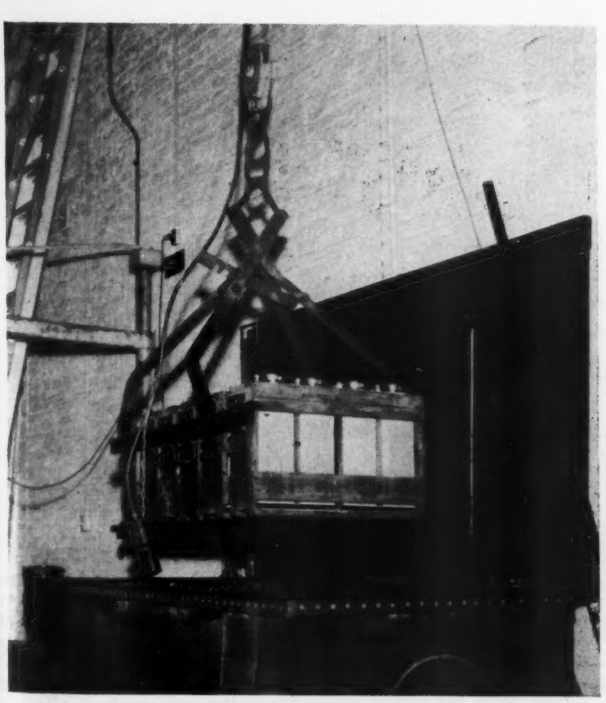


Above: General view of the storage end of the battery room taken just behind the crossways passageway and showing the wide lengthwise aisle which leads to a doorway in the left hand corner of the room. Storage space for batteries and large equipment is along the right wall. Small parts are stored along the rear wall, which space is served by a stairway and ramp

Right: Individual steel-alkaline battery trays are dipped and suspended for dripping by this small hook arrangement. While the tray shown above is dripping excess paint, a second tray is setting in the tank

Handling Batteries in the Shop

The Illinois Central handles all the batteries from passenger cars being overhauled at the Burnside Shops, Chicago. The work is done in a separate room 45 ft. by 100 ft,, which can be considered to be divided, though not partitioned, into two sections, a storage end and a working end. The boundary between the two is an 8-ft. passageway across the short dimension of the room extending between doorways in the two side walls.



Groups of six trays can be dipped at one time using the above holder

The battery reconditioning section extends for the first 40 ft. to this passageway, with the remaining 60 ft. devoted to storage on the floor and along one of the side walls and the end wall. The area adjacent to the other side wall is for power generating equipment in the battery shop. A second 8-ft. passageway enters this side wall near the end wall and extends to the lengthwise center of the storage section, thence down the lengthwise center until it meets the first passageway. These passageways are a valuable help in material handling; they permit fork lift trucks to maneuver anywhere in the storage section and on the storage-section edge of the reconditioning section. Ground movement of batteries within the reconditioning area is generally done with a hand-operated lift truck. Batteries to be moved by the fork trucks and those in storage are on skids; those to be moved by the hand lift truck within the reconditioning area are on flats.

Batteries are moved between skids and flats, and for paraffin or paint dipping, by jib cranes, of which there are two. The principal crane has a 15-ft. radius, an electric hoist, and can swing in a full 360-deg. arc. The 360-deg. swing is made possible by the method of distributing the power to the motor. Current is fed to trolley-type contactors from circular bus bars mounted above the jib support. The small jib crane has a radiu sof 8 ft. and is used for dipping lead-acid batteries in the paraffin tank.

Steel-alkaline batteries are handled either as single trays or in groups of six trays for dipping in the paint

tank. Single trays are held by a special lifter for this operation, while groups of six are held either by a second lifter or in the cradle. In either case, one tray or group of trays is dipped while a second is held suspended over the tank for the excess paint to drip off, both operations requiring an average of five to ten minutes.

When the cradle ball bearings are removed, the batteries and the cradle are usually dipped together with the batteries in place in the cradle. When the batteries require painting only, the bearings are normally removed from the cradle and the batteries and the cradle dipped together. When the batteries need a general overhaul, they are usually removed and dipped separately from the cradle after repairs. At the same time, the cradle is usually stripped to remove dust and dirt, given a general overhaul, and then dipped separately.

Armature Nut Wrench

By Michael Axler

On our subway motors, the nuts that hold the pinion on the armature shafts are made as shown in Fig. 1. The original nuts had four rectangular slots cut 90 deg. apart from each other on the edge of the nuts. These are shown by the solid lines. To remove or apply a nut, a wrench was used which had four projecting prongs which fit the four slots.

After a time in service, the pins would break off and would have to be replaced. The breakage was not excessive, and the wrenches and nuts were used for years. Then, we adopted pneumatically-operated impact wrenches for applying and removing the nuts. This is when our troubles started. The breakage of wrench prongs became intolerable. It was necessary to employ all the time of one man to repair wrenches.

To correct the trouble, a new wrench was developed as shown by the solid lines in Fig. 2. In the place of the rectangular prongs, we used standard No. 9 taper pins, driven into taper reamed holes, and held in position by a large nut on the back of the wrench. The pins are heat-treated and breakage is very low. When one does break, it is an easy matter to take off the nut, drive out the old pin, and replace it with another.

* New York City Board of Transportation, I.R.T. Division.

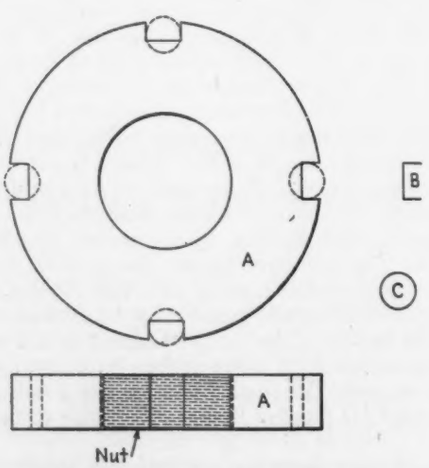


Fig. 1—Design of old and new pinion nuts

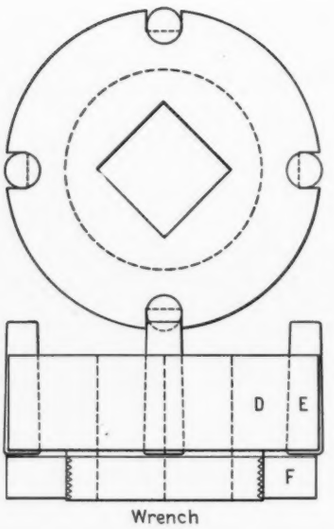


Fig. 2—Rectangular pins in the old wrenches were replaced with standard taper pins.

It was, of course, necessary to change all the nuts to match the new wrenches. Old nuts were cut out on an end mill as shown by the dotted lines in Fig. 1. New nuts are drilled.

Paul Bunyan Oven

Recently completed and now in operation is this huge varnish insulation curing oven at the Westinghouse Electric Corporation's manufacturing and repair plant in Buffalo, N. Y. Largest of its kind in western New York, it is 8 ft. wide by 13 ft. high and 15 ft. long. The oven is heated by either gas or electricity, and equipped with automatic controls to maintain constant temperature throughout. An air-changing system keeps the heat in continuous motion and results in effective evaporation and removal of varnish solvents.

What Tests For G.E. Governors?

The tester for G.E. diesel locomotive governors, developed by the Erie, and described in your December 1951 issue provides a simple and quick way of making tests. But, is it complete? Are there not other checks which need be made to insure satisfactory operation of the governor?

Test Stand for Governors on Alco-G.E. Locomotives

Any governor, after it is overhauled, should be thoroughly tested, including a running which simulates as closely as possible actual operation on the locomotive. The simulated operation should be fully comprehensive, duplicating, if possible, every set of speed and load conditions to which the governor is likely to be subjected in actual operation. This is imperative because it is far cheaper to find some obscure malfunctioning in the repair shop than to find it on a locomotive pulling 15 cars full of passengers.

The General Electric Type 17MG test stand (Fig. 1) provides for such testing of the Type 17MG3 and 17MG6 electro-hydraulic governors used on Alco-G. E. road locomotives. Its several components duplicate very closely the operating characteristics of the locomotive power plant, and thus simulate very closely actual locomotive operation.

As shown in the block diagram (Fig. 2) the governor on the test stand controls operation of an air motor which drives a tachometer and a small d.c. generator. The test stand is also equipped with an oil system for supplying pressurized oil to the governor; a motor-amplidyne set for exciting the d.c. generator; and a control panel. The control panel contains starting switches, generator load rheostats (and generator loading resistors mounted in the back), and the various gages and instruments.

Description of the Test Stand

The hydraulic system on the test stand is made up of a 10-gal. oil tank, an oil pump driven by a ¾-hp. a.c. motor, an oil filter and associated piping. Several gate valves, a pressure relief valve and an oil pressure gage are used to enable testing of both MG3 and MG6 governors. All valves are accessible at the front of the test stand in order to be convenient for the operator as can be seen in Fig. 1.

The source of power on the test stand is a 1½-hp. air motor. This air motor together with the air throttle valve have characteristics which are very similar to those of the diesel engine. Actually, it has less inertia and thus the test stand checks governor performance to a greater degree than is required for the diesel engine. Directly connected to the air motor is a 125-volt, 500-watt, d.c. generator which corresponds to the traction generator on the locomotive. Driven by means of a pulley on the air-motor shaft and a V-belt, is the tachometer generator. This generator is a duplicate of that used on the Alco-G. E. road locomotive. A motor-amplidyne set is used to excite the generator on the test stand. Although this amplidyne is driven at constant speed by the a.c. motor, it has similar characteristics to the amplidyne exciter used on the locomotive.

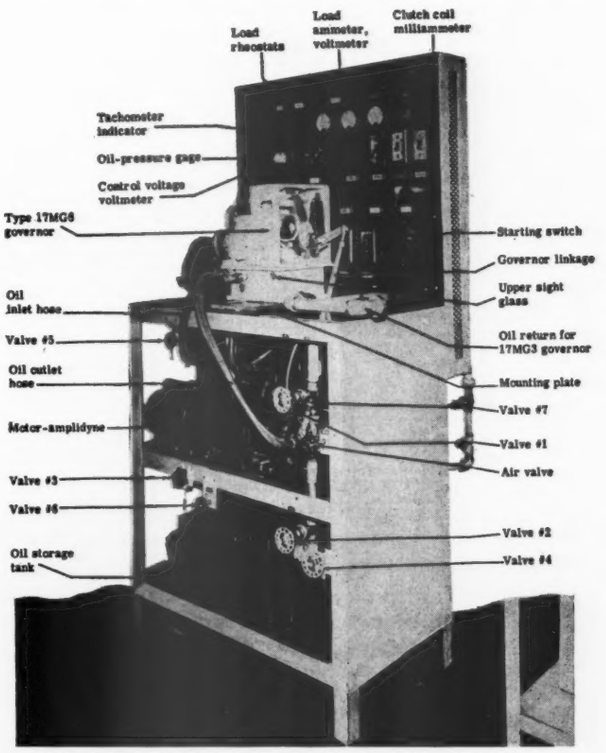


Fig. 1—Test stand for 17MG3 or 17MG6 governors showing 17MG6 governor mounted for testing

The panel on the test stand contains all meters and necessary electrical controls. Two load rheostats are connected across the output of the generator and are used to vary the load applied to the system. The load ammeter and voltmeter are used to measure the generator output and thus determine the power which the air motor is producing. A heostat and milliammeter are used in the governor-clutch-coil circuit for checking the holding power of the clutch arms. The clutch-coil current may be reduced to the minimum value encountered on the locomotive when engine cranking is taking place. This, of course, is the condition in which holding power of the clutch arms is critical, since the battery voltage is low. A rheostat in the speed-solenoid circuit is used to vary the air-motor speed. This speed is shown in r.p.m. on the tachometer indicator. The 100-volt, d.c., voltmeter is used to measure control voltage. It is essential that this voltage be held constant throughout the test. A rheostat in the amplidyne field circuit is used to vary generator field current and thus generator output. Various other switches used to energize the oil pump, motor-amplidyne set, control circuits, etc., are also located on the panel.

The use of the test stand can be better visualized by a

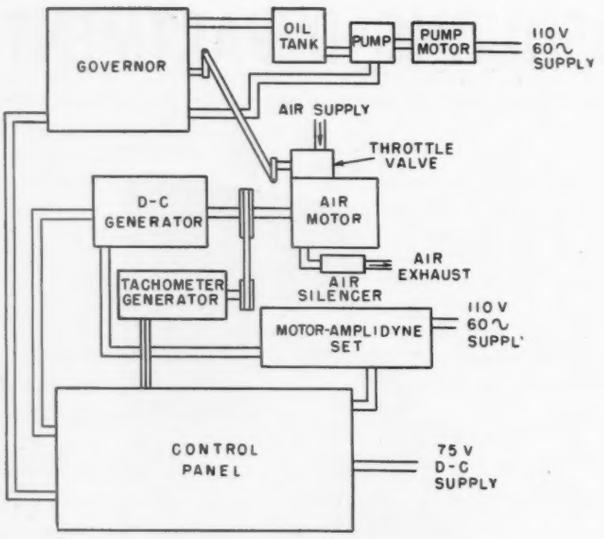


Fig. 2—Block diagram of governor test stand.

brief descripture of the testing procedure followed on all governors.

Preliminary Checks.—A resistance check of the following elements is necessary to assure that there are no open circuits or shorted turns. These measurements must be taken with a Wheatstone bridge to be of any value.

Item	Resistance Ranges
Clutch coil	362 -412 ohm
Speed winding	15.2- 17.3 ohm
Stabilizing winding	49.5- 60.5 ohm
Fuel limit speed winding	15.2- 17.3 ohm
Stabilizing rheostat	112.6-124.4 ohm
Load control rheostat	10.2- 11.2 ohm
Fuel limit rheostat	166 -184 ohm

The brush arms are set and this setting later verified by performance in the running test. The overtravel spring wind up must be checked to assure that no binding or excessive friction is present.

Static Tests.—After the governor is wire checked and a resistance check made of all governor circuit elements, it is bolted to the mounting plate on the test stand. The oil lines are connected to the governor and the test-stand valves are adjusted in order to provide the proper hydraulic system for the type of governor being tested. After oil pressure is obtained and the oil temperature reaches the operating range, the pressure regulator is adjusted. The oil pressure must be set for 125 to 135 lb. per sq. in. to assure that correct slave-piston response is obtained. This is followed by a thorough inspection of the governor for leaks. The stabilizing, load control and fuel-limit brush arms are next adjusted on the governor. The test-stand amphenol receptacle is then connected to the governor plug and the clutch arms are brought together and checked for fit. The next test involves the installation of a special pointer on the output shaft of the governor and checking the degrees rotation of this shaft throughout its complete travel. This test assures that proper rack travel is obtained on the diesel engine. Tests are made on the clutch arms to assure a close fit between the mating surfaces. Several clutch-coil tests are made which involve testing for minimum holding torque with reduced current passing through the clutch coil. A check of residual holding torque is made to assure that the arms will separate and shut down the diesel engine when necessary. All of these tests are made without the use of the air motor.

Running Test.—The running test is very important since the balancing current is properly adjusted in the speed and fuel-limit solenoids during this test. The no-load check at all speeds verifies that smooth operation is attained with freedom from hunting. Operation with various percentages of load simulates actual road conditions and the speed indicator will show that the pre-set speed is held during these conditions.

The output shaft of the governor is connected to the air throttle valve by the mechanical linkage. With 75 volts applied to the control circuits, the air motor is started by means of the starting switch. The governor controls the speed of the air motor as dictated by the setting of the speed rheostat. The speed- and fuel-limit solenoid currents are next adjusted during this no-load running test. Operational checks at various speeds throughout the entire range are then made. With the motor-amplidyne running, load testing is started. By closing the amplidyne field circuit and adjusting the field rheostat and load rheostats, any amount of load may be obtained. This phase of the testing is very important since no-load and full-load speeds may be compared and any speed droop detected.

Hipot Test.—A high potential test of the governor will round out the testing. This would consist of applying 800 volts, 60 cycles, from a special high-voltage, low-power tester, for a period of one minute.

Since the above operations simulate any conditions of speed, load and fuel limit met in actual operation, it is evident that any G. E. governor which has been adjusted and tested on a type 17MG governor test stand will perform properly in service on the locomotive.

Trouble Shooting

In addition to routine testing of governors after overhaul, the test stand is valuable for trouble shooting. A governor which is operating improperly on the locomotive may be replaced with a governor known to be functioning properly. The ailing governor may then be put through its paces on the test stand and the locomotive can go on its way in revenue service.

Overhaul Facilities

In overhauling governors, there are two other main requirements besides the adequate test facilities as described above. One is a clean, dust-free area, and the other is adequately trained personnel. Many railroads already have dust-free rooms in their shops in which are located repair facilities for fuel-injection equipment and/or other type governors. The main requirements for personnel are an elementary knowledge of electricity and good mechanical ability. Attending the Alco-G. E. Locomotive School would give these personnel an excellent background in the equipment.

The decision of whether to rebuild governors locally or to return them to the manufacturer's service shop will usually depend on the number of units in service. Many railroads have found it economically justifiable to train governor specialists, provide dust-free rooms and purchase test stands. Other roads using Alco-G. E. locomotive have perferred to return their governors to regional renewal parts offices on a repair and return or unit exchange basis.

R. D. BEARD
General Electric Company
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EDITORIALS

The Car Man and Claim Prevention

Car supervisors and employees, play one of the most important roles in railroad claim prevention because they work in the department where the remedy for all car conditions responsible for freight loss and damage depends upon close inspection and prompt action. Claim prevention has received much attention in the past and much good has been accomplished, but, as usual in co-operative efforts where many men from different departments must be taught and stimulated to greater effort toward one common goal, the need for further intensive education seems never ending.

In this case, especially, the job is obviously not yet completed, for loss and damage claims seem to be on the increase, even more than could be accounted for by the depreciated dollar value of today. In 1951, for example, records indicate that American railroads paid roughly $99 million in loss and damage claims, or $11 million more than in the preceding year and over four times as much as the $24½ million paid in 1941, just ten years earlier. A little calculation shows that this really staggering loss during the calendar year of 1951 amounts to about $275,000 a day; $11,500 an hour; or $190 every minute.

In quoting these figures at a recent meeting of car men in St. Louis, H. H. Wills, superintendent of station and claim prevention, Missouri Pacific, said: "American railroads individually are awake to the situation and in all of the United States there is not a Class I railroad that I know of that does not have an organization devoting its entire time to claim-prevention activity. Practically all railroads have, in one form or another, inaugurated special claim-prevention campaigns and some roads have inaugurated teaching and training programs aimed not only at saving the terrific drain on their revenue but, even more important, providing a vastly improved service to customers."

In connection with work the Missouri Pacific is doing along this line by means of booster committees and special district five-man claims-prevention teams, it is interesting to note the major contribution made by a claim prevention instruction car which is mechanically cooled, supplied with 44 comfortable, tiered seats and the latest instruction aids, including loudspeaker, blackboard, moving pictures and slide projector. This car, with a self-contained power plant for lighting, heating, air-conditioning and other purposes, can be moved anywhere in yards or stations for holding instruction classes. Failures occurring at individual points are thus brought to the attention of the local men most interested and responsible. Causes are analyzed, preventive measures proposed and full discussion encouraged to develop all possible suggestions from men in the rnaks.

Mr. Wills points out that the effectiveness of general claims prevention work on the Missouri Pacific is shown by the fact that claim payments on this road dropped from $3,440,369 in 1948 to $2,722,628 in 1949; $2,013,-452 in 1950; $2,482,200 in 1951. Car men undoubtedly helped much in this achievement for they are primarily builders and repairers and hence adverse to waste and destruction. By combining their knowledge of equipment conditions with the claim man's knowledge of damage causes, a strong team effort results.

Car men are supposed to keep freight cars clean and in good mechanical condition, but they can probably help most by such prosaic things as removing all nails and projections which tear lading; by making sure that floors are sound and smooth; by checking old classification cards and removing all trace of previous contaminating loads; by removing these cards each time a car is loaded or selected for loading; by restencilling illegible marks such as car numbers and weights; and working patiently with shippers whenever necessary to demonstrate safe loading methods for general as well as special loads and explaining the reasons of safety which make strict adherence to A.A.R. loading rules essential.

How Important Is High Availability?

Railroads today go to great extremes to achieve maximum mileage and availability from diesel power. They figure out complicated assignment cycles to get the last mile per month from each unit. They increase the lengths of locomotive runs even to the extent where a unit may end up a thousand miles away from its maintenance terminal at some point that cannot handle either efficiently or quickly any heavy work that might be needed after the long run. They go to the further extreme in some instances of changing train schedules for the primary reason of getting maximum locomotive mileage rather than maximum freight or passenger business.

After going to all this fuss and bother to get the last mile out of each diesel locomotive, many roads then fail to take the one final step necessary to achieve in practice the mileage set up on their paper schedules. They fail to keep on hand at turnaround terminals an adequate supply of new or reconditioned major assemblies.

It is true of course that the need for such a supply does not occur frequently enough to be a problem where a turnaround terminal handles only one make of diesel. Neither does it happen frequently to the make of diesel assigned to a point for heavy maintenance even though that point may give turnaround or other servicing to other makes of locomotive.

It can be a problem where two or more makes of diesels operate through between two points a consider-

able distance apart, say 500 to 1,000 miles, and where one make is given heavy maintenance at one end of the run and the other at the opposite end. The first receives its heavy maintenance at the north terminal but winds up on the south end with two defective cylinder assemblies. None are available, or perhaps only one.

The locomotive then must lay over until the necessary part or parts can be obtained from outside sources, shipped from the heavy maintenance terminal, or reconditioned at the local terminal which may not be too well equipped for handling this work rapidly on the make of diesel foreign to them. Or—and this can happen more often than records indicate—the defective unit is returned dead to its home terminal.

In any event more availability and more revenue miles can easily be lost by inadequate spare parts than can be gained by complicated assignment schedules, long runs or changed train schedules. How many mechanical departments have checked their records carefully to learn what the true picture is? It seems likely that the true picture will reveal that high availability and mileage will be best attained in practice as well as in theory when all maintenance points carry adequate spare parts inventories for all makes of locomotives with which they come in regular contact, including any that might be assigned to other locations for heavy maintenance.

Cleaning Generators in Place

It has been the ambition of nearly every diesel locomotive maintainer to clean main generators in place on the locomotive. Some generators need it a lot more than others. Some locomotives operate in dusty territory, some are subject to fine powdered snow, the trailing unit usually gets more dirt and heat than the others, and circumstances are seldom twice alike. But, there is certain to be some oily vapor in a locomotive. There is dirt from the outside, there is carbon-brush residue, and brakeshoe dust has a way of getting into everything. If the accumulation on the surfaces of the armature and brush rigging become sufficient, flashovers are almost certain to occur.

Regular practice of blowing out the generator with air will relieve it of a lot of accumulation, but it cannot remove dirt that is embedded in the insulation or held by an oil film. One road cleans with a blast of air and corn meal and removes the corn meal with the dirt that comes with it by using a 5-hp. vacuum cleaner. The suction nozzle is a piece of rubber hose. Other roads spray clean with various types of solvents and employ different methods of draining them out and drying them out with air. One operator feels that if he could do this often enough, beginning when the generator was new, he could keep it clean.

Others place more emphasis on the importance of keeping dirt out of generators; almost as much attention is given to body filters as to the engine air filters. On one passenger run, in very dusty territory, one railroad changes out the body filters on the third unit on every run. Others criticize such procedure, saying, "What's the use. If it's hot, the operators will run with the side and end doors open." Still other proponents of preventive maintenance have given much attention to air flow inside of the locomotive, redirecting it so that it enters at the generator and then moves across the engine.

The preponderance of operators hold the opinion that there is no royal road to trouble-free operation. It would appear from their experience that there is no substitute for intelligent inspection which includes the making of electrical tests. They feel that the only sure way to keep out of trouble when the insulation resistance begins to run down is to remove the generator from the locomotive and restore its condition.

NEW BOOKS

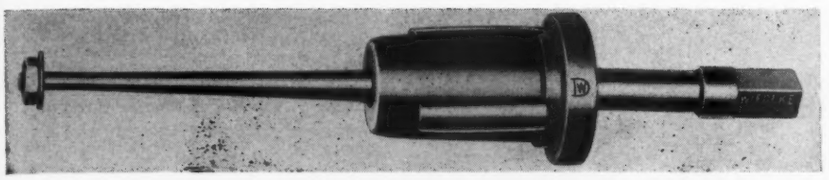
HANDBOOK OF ENGINEERING FUNDAMENTALS. *Second Edition. Published by John Wiley & Sons, 440 Fourth avenue, New York 16. 1,324 pages, 5½ in. by 8 in. Leather bound. Price $10.*

The discussions on mathematics, thermodynamics, and fluid mechanics have been entirely rewritten or revised in this new edition of the Handbook which has been prepared by a staff of specialists under the editorship of Ovid W. Eshbach of the Northwestern Technological Institute. The sections on electricity and magnetism, engineering materials, and engineering law have been similarly revised, and a section added on aerodynamics stresses theory basic to the design and performance of aircraft. Engineering tables now include standard structural sizes for aluminum, as well as data on tangents and offsets for the use of civil engineers. The table on standards and symbols has been brought up to date, and tables added for surveyors. Greater emphasis has also been given to the MKS system of units which has been incorporated in the table of conversion factors.

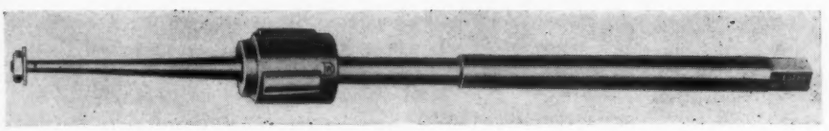
STANDARD PRACTICES FOR STATIONARY DIESEL ENGINES. *Third edition. Published by Diesel Engine Manufacturers Association, 1 North LaSalle street, Chicago 2. 197 pages, 6¼ in. by 9 in.; illustrated. Cloth bound. Price, $5.*

This book is the product of member companies of the Diesel Engine Manufacturers Association which coordinated their engineering and sales departments and delegated representatives to revise the 17 chapters of the 1946 edition. Sections dealing with dual fuel engines, operation and maintenance, and starting systems have been added, also new material in an appendix. The chapters of the new edition cover Definitions; Performance and Equipment; Diesel Engine Construction; Governors and Speed Regulations; Torsional Vibrations and Critical Speeds; Intake and Exhaust Systems and Heat Recovery Apparatus; Starting Systems; Cooling-Water Systems; Lubricating-Oil Systems; Fuel Storage and Handling Systems; Generators and Electrical Equipment; Selection of Engine Sizes; Diesel Power Plant Buildings; Erection of Diesel Engines; Lubricating-Oil Characteristics and General Specifications; Field Test Code; Suggestions Covering the Preparations of Invitations for Bids and Detailed Specifications, and Operation and Maintenance.

NEW DEVICES



Expander A



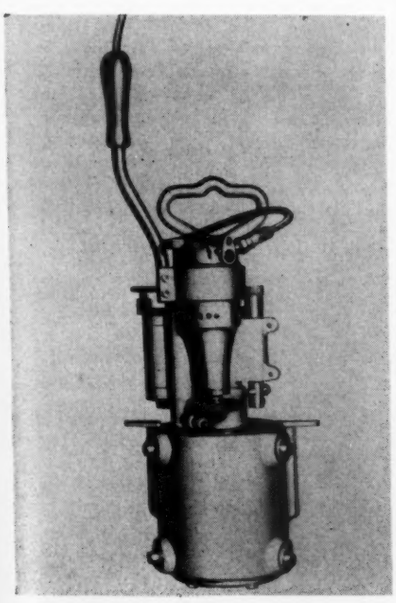
Expander B

Cylinder-Head Sleeve Expanders

The Gustav Wiedeke Company, Dayton 1, Ohio, has designed two new Ideal expanders to roll both ends of a diesel cylinder sleeve parallel in a cylinder head.

Expander A is used for the upper end of a cylinder head. It has an inset shoulder to position cylinder sleeve while rolling.

Expander B is for the lower end of a cylinder head sleeve and is suitable to reach through and expand tube parallel to the cylinder head. It automatically positions itself for rolling.



Portable Ridge Grinder

A portable ridge grinder that grinds true to the worn contour of cylinder liners has been developed and introduced by B. K. Sweeney Mfg. Company, Denver 17, Colo.

It is claimed that this device feathers-out the ridge so that pistons and rings can be readily withdrawn through the top of the cylinder.

The tool can be used to remove ridges from either chrome-plated or cast-iron liners in less than three minutes. It is adjustable to fit any size liner from 7⅞-in. to 16-in. inside diameter. Units can also be furnished to fit any size work up to 25-in. inside diameter.

A built-in wheel dresser provides for wheel dressing without removing the grinder from the work surface. Total weight of this portable device is 32 lb.

◆

Hard Shell Cup Grinding Wheel

A cup grinding wheel which retains its sharp cutting edge throughout its service life has been announced by the mechanical goods division, United States Rubber Company, New York 20.

The wheel has a hard shell of tough resin-bonded abrasive built around a core of rapid-cutting resin-abrasive construction. This shell, which is 3/16 in. thick, resists mushrooming or rounding of the wheel's cutting edge. Wear occurs evenly across the entire face of the wheel. It is particularly useful for grinding accurately hard-to-reach corners and complicated shapes, and is applicable in welding, foundry operations, finishing welds and machine shop work.

The wheel, marketed under the trade name U. S. Royalite hard-shell cup wheel, has an overall diameter tapered from 6 in. to 4¾ in. and a thickness of 2 in. It is available for three standard types of arbors.

A Chemical-Resistant Paint

Ferrolastic chemical resistant coating, a product of McDougall-Butler Company, Inc., 2929 Main Street, Buffalo 14, is formulated with a resin, the outstanding characteristics of which are adhesion, flexibility and chemical resistance. These features have indicated substantial savings both in labor and material when used on covered hopper and tank cars subject to corrosive action from such lading as soda ash, cement, liquid chlorine, and other alkalis.

Good chemical resistance was observed in tests conducted in the laboratories of four large eastern railroads. In actual service tests the coating was found to combat successfully the damaging action usually resulting from spillage. The finish of covered hopper cars used in cement and soda-ash service is said to be in excellent condition after 1½ years' service. Tank cars in liquid chlorine service also present good appearance and durability after 17 months.

Because of its exceptional adhesion, no primer is required, so that two coats of Ferrolastic are usually sufficient to obtain adequate metal protection. It can be applied over a wire-brushed surface without sand-blasting or removing old finish, and can be hot sprayed at 170 deg. F. The coating has all the characteristics of an ordinary synthetic enamel—gloss, durability, and dry.

◆

Oil-Tight Pushbuttons

A new line of oil-tight pushbutton units for machine tool applications was announced recently by the General Electric Company's Control Department, Schenectady, N. Y.

The units, made up of operators, color rings and contact blocks may be arranged like building blocks in various combinations.

Coding of pushbuttons with the new color rings—available in brilliant, permanent shades of black, red, green, yellow, and white—is accomplished by screwing the ring onto the neutral-colored button. Be-

cause the color identification is on the ring, away from the area of use, it does not become discolored from dirt and grime. Also, the larger color surface can be seen more easily by the operator.

New "self-a-line" double-break contacts are placed at an angle so they close with a rolling action. Only one basic form of contact block is used in the new units—a single-pole, double-throw type made of Melamine for maximum arc resistance. Double-pole, double-throw combinations are made by mounting two of these units on the same base, and tandem combinations giving up to four normally-open and normally-closed contacts can be made by combining four blocks with an adapter plate.

The aluminum enclosures meet all J.I.C. specifications and are finished in machine-tool gray. Offered with 1, 2, 3, 4, 6, and 9 button stations, they are fully oil-tight. Depth of the unit is $3\frac{7}{32}$ in., and a standard pushbutton extends ½ in. beyond case. Other dimensions depend upon the number of stations in the unit. Contacts are rated at 115, 230, 460 and 575 volts.

◆

Oil-Resistant Filler Tape

An oil-resistant tape for rapid insulation build-up on splices in large power cables has been announced by Minnesota Mining and Manufacturing Co., 900 Fauquier street, St. Paul, Minn.

Designated "Scotch" brand electrical tape No. 25, it is made of synthetic rubber providing greater dielectric strength and resistance to high temperatures than natural rubber tapes.

The chemical-resistant qualities of the tape make it especially suitable for use in oil drilling, mining and underground cable operations, while the 40-mil thickness and extreme stretch (1,500 per cent breaking point) make possible smooth insulation wraps on irregular surfaces.

Dielectric strength is 15,000 volts unstretched, and 10,000 volts at 500 per cent elongation. It has an electrolytic corrosion factor of 1.0 and an insulation resistance of 100,000 megohms.

The tape is available in ¾-in. by 15-ft. rolls, is green-colored, and has a white strippable liner to be removed before use.

Since it fuses to itself, forming a solid homogeneous mass, it requires no adhesive. The tape is not designed as a sole insulation. "Scotch" plastic electrical tape No. 33 is recommended as the outer wrap for protection against moisture, weather, and abrasion.

◆

Diesel Control Circuit Jumpers

Control jumpers for diesel-electric locomotives are now being made by the Pyle-National Company, Chicago. They consist of a 250-volt multi-conductor cable and two plug heads molded in Hycar, a product of the B. F. Goodrich Chemical Company. The cable and plug heads are vulcanized together to form a one-piece unit, which sometimes incorporates as many as 27 circuits. The plugs, each $5\frac{3}{16}$ in. in diameter and $9\frac{7}{8}$ in. long, are shaped to permit a comfortable hand grip and are designed to absorb the flexing strain imposed on the cable during operation.

Rough handling and dragging on the railroad bed when disconnected make it necessary to use a durable material to protect the plug head contacts. Besides having good abrasion resistance, Hycar resists the damaging effects of coal dust, salt-water spray, greases, most acids, human waste, and is not affected by weather or extreme temperature changes.

◆

Parallel Side Wood Screw

A new type of wood screw, designated the Twinfast, is now being produced by the Townsend Co., New Brighton, Pa. This product has two threads with twice the pitch and drives twice as fast as a conventional wood screw

With a single, centered point, the screw

affords quick starts and balanced driving. It has parallel sides, is not tapered, and therefore has more thread area in contact with the material for more holding power. The shank or unthreaded portion is the same diameter as the thread pitch.

The screw is made of steel or brass in all standard sizes with flat, round and oval heads—slotted or Phillips cross-recessed.

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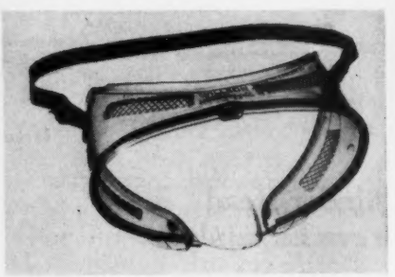
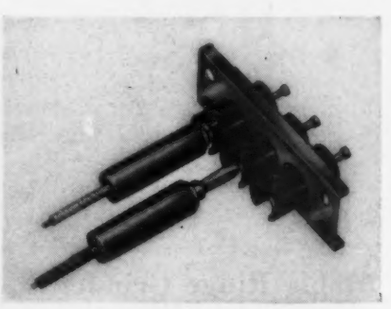


All-Plastic Safety Goggle

An improved, all-plastic safety goggle manufactured by Willson Products, Inc., Reading, Pa., has a flexible, fully transparent frame molded of Vinylite. Although the frame comfortably conforms to all facial contours, a newly designed lens retaining feature adds sufficient rigidity to the frame so that there is no sacrifice of protective efficiency. The lens is of .060-in acetate, and is separately replaceable. The goggle, known as the Willson No. 91 MonoGoggle, weighs just over an ounce and fits easily over all types of prescription glasses.

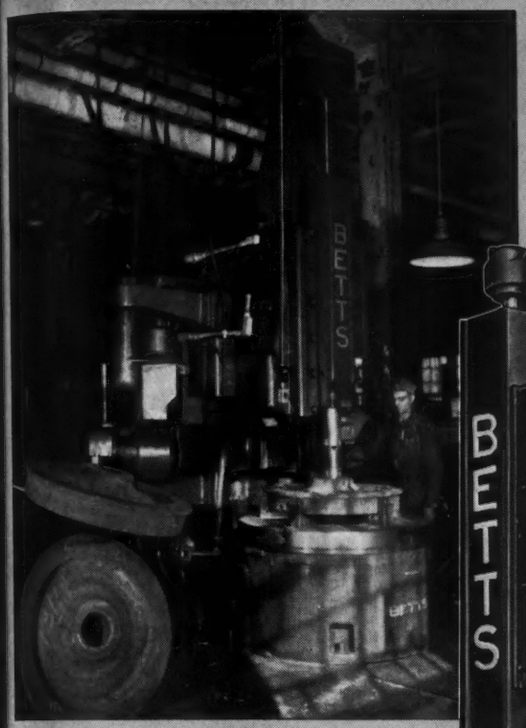
◆



Terminal Block

A terminal block, known as the Curtis FTB, has been developed by the Curtis Development & Manufacturing Co., 3266 North 33rd street, Milwaukee 16, for quick connect and disconnect requirements in experimental work. The block is similar to the FT type, used for sub-panel and

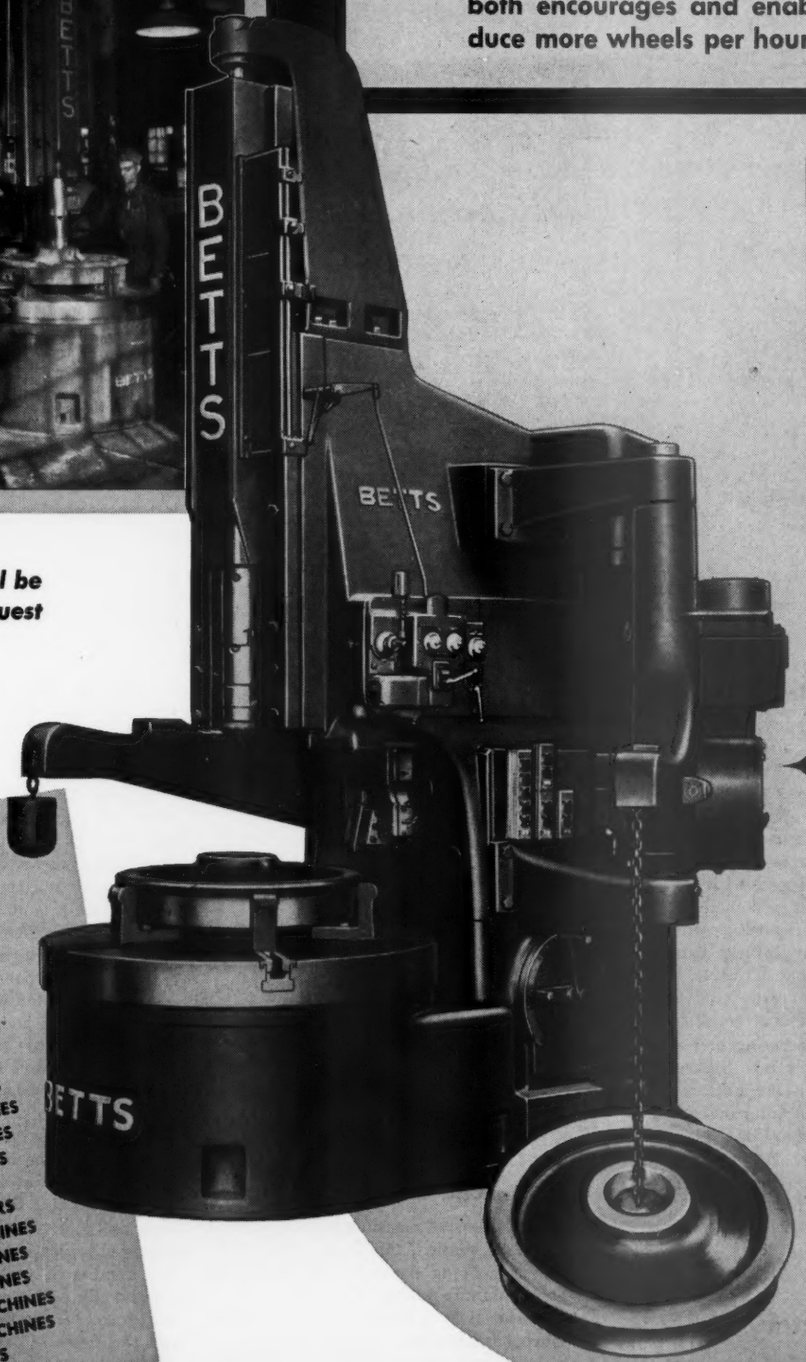
BETTS HYDRAULIC FEED CAR WHEEL BORER



It's the average daily wheel production that counts . . . .

not a dress parade run of an hour or a day

This modern machine's simple, automatic operation both encourages and enables the operator to produce more wheels per hour . . . day in and day out.



Full automatic cycle from loaded start to stop, controlled through trip dogs with supplementary manual operation at any point in the cycle.

Wide speed range for use of either high speed steel or carbide tools with automatic speed reduction for combination roughing and high speed steel finishing.

Chuck jaws independently adjustable on sub-bases, eliminating frequent regrinding to maintain accuracy.

Boring sizes up to 12" diameter. Wheel tread diameters up to 48".

Available with either flange mounted or taper shank type boring bar.

Automatic brake stops table before spindle traverses upward, preventing scoring of the work.

Square-type ram with adjustable gibs on each side for maintaining constant, close accuracy. Hydraulic cylinder in line with boring ram.

Full information will be furnished upon request

Among Railroad Tools built by Consolidated are . . .

CAR WHEEL BORERS
DIESEL WHEEL BORERS
BURNISHING LATHES
TIRE MILLS
END DRIVE AXLE LATHES
CENTER DRIVE AXLE LATHES
JOURNAL TRUING LATHES
DRIVING WHEEL LATHES
CAR WHEEL LATHES
RADIUS LINK GRINDERS
PROFILE MILLING MACHINES
SLAB MILLING MACHINES
ROD MILLING MACHINES
CYLINDER BORING MACHINES
KEYWAY MILLING MACHINES
CRANK PLANERS
DRILL PRESSES
AND OTHERS

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED
MACHINE TOOL CORPORATION

SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

chassis work. It is of the feed-thru type with solder or screw connections on one side and provisions to receive banana plugs on the other. Banana plugs are not furnished with the FTB block.

The unit is factory assembled in any number from 1 to 16 terminals, which are separately insulated and held permanently in a metal strip.

The FTB is conservatively rated at 300 volts between terminals of opposite polarity and to ground—20 amps.

◆

Insect and Odor Destroyer

Hysan Products Company, Chicago, has announced a machine, called the Hy Tron, that combines odor and insect control. It is designed to destroy odors and kill flying insects simultaneously and by throwing a switch, it can be made to perform either of these functions separately.

The machine is equipped with an electric fan for delivering freshened air and a heating element that vaporizes a Lindane-based insect tablet for killing flying insects. It is fused so that it meets Health Department and other state and federal safety requirements. It has a pilot light that tells when it is operating and a thermostat for automatic control. A bracket is furnished for use when the unit is to be mounted on the wall. A hinged back door may be opened with a key for replacement of the air freshener.

The unit may be touched without fear of burning fingers or hands.

◆

High Capacity Petroleum Meter

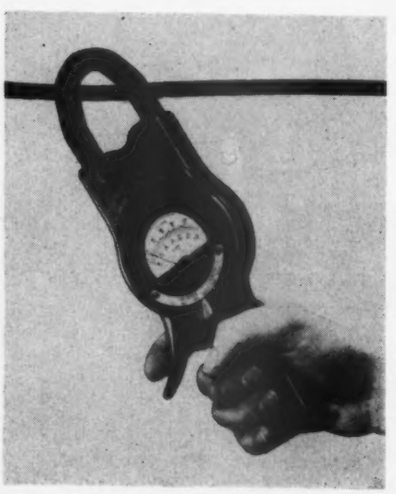
Suited to bulk plants and terminals, this new 4 in. Red Seal Meter, manufactured by the Neptune Meter Co., New York 20, offers the Auto-Stop delivery feature. It is compact, lighter in weight and fits practically any piping layout. There is only one moving part in the oscillating piston type measuring chamber.

The Auto-Stop automatically cuts off

flow at the desired gallonage. Designed for low loss of head, the valve is cushioned with a double trip to cut off high rates of flow smoothly. Capacity of the type C meter is 650 gal. per min. without Auto-Stop, 500 gal. per min. with it. Print-O-Meter ticket printing registers are also available.

This meter is available with four types of weatherproof registers: model 441, direct reading; model 442, Auto-Stop; model 443, Print-O-Meter; and model 444, Auto-Stop Print-O-Meter. It is also available with the Neptune remote control system to put full control inside the office.

◆



Tong Test Volt-Ammeter

An instrument for measuring both current and voltage, called the Type AC-1 volt-ammeter, is being made by the Columbia Electric Manufacturing Company, Cleveland, Ohio. It is a clamp-type, hand-sized measuring instrument. Current readings are made without breaking circuit or insulation. To read amperes, the trigger is pressed, opening the pair of insulated jaws so that they can be encircled around the power cable or bus bar. The jaws will accommodate cables up to 1½ in. in diameter, and bus bars up to 2 in x ½ in. Four current ranges are available: 0-12, 0-60, 0-120 and 0-600 a.c. amp.

Voltage leads may be quickly and safely plugged into the handle of the instrument. Two voltage ranges are available—0-150 and 0-600 a.c. volts. The instrument weighs less than two pounds. Overall dimensions are 11 in. x 3½ in. x 1⅞ in.

The trigger and housing of the instrument are constructed of a durable molded phenolic material. Accuracy is plus or minus 3 per cent of full scale deflection. The complete unit includes voltage leads and carrying case.

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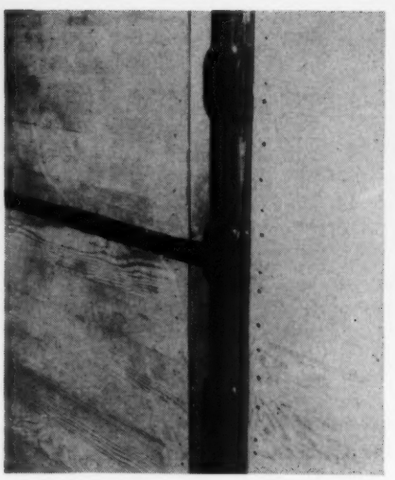


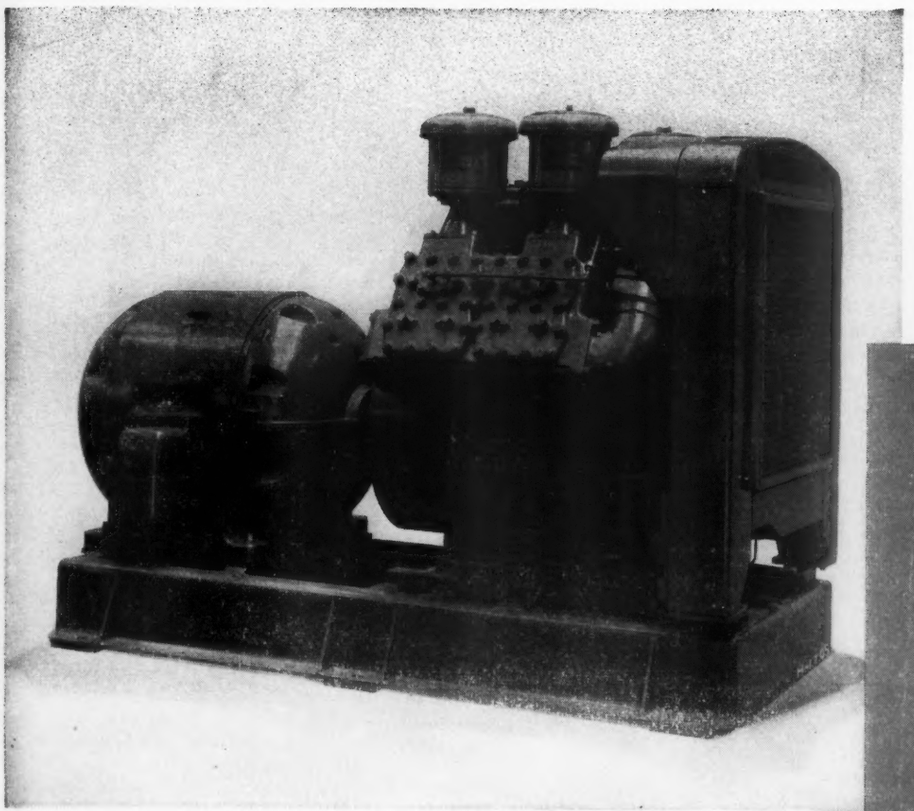
Lading Strap Anchor

A full length intermediate lading strap anchor which can be used in conjunction with existing door post anchors has been developed by the Pullman-Standard Car Manufacturing Company of Chicago. With this device for reducing side lining damage, shippers can anchor unit loads with high weight and small volume to box cars without nails, and they can also use the lading strap anchor with temporary bulkheads for other types of shipments.

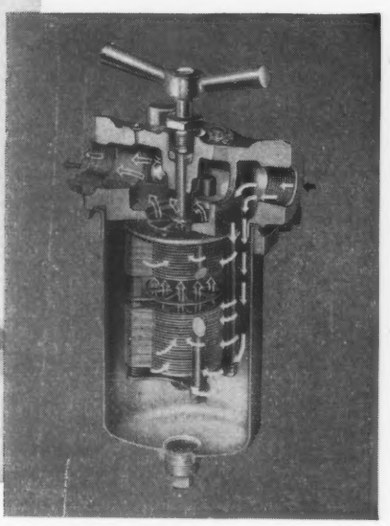
The new Pullman-Standard Lading Strap Anchor for intermediate posts keeps box car linings and floors nail-free. It thereby eliminates hazards to personnel, lading and equipment, as well as costly repairs to linings and floors when temporary anchoring devices are used.

The anchor is recessed into a slot in the lining so that the exterior is flush with the side lining to avoid catching lading or denting cartons. It extends the full height from the floor to the roof and has approximately 13 locations for fastening straps. The number of anchors to be installed per car and the points of installation are determined by the needs of the road involved and the types of lading to be secured.

The anchor does not interfere with side lining replacement, and it can be removed and replaced without disturbing side lining. The anchor further can be easily replaced or repaired, if damaged in service, using common bolts or nuts. No concealed welding or special fasteners are used. The side lining installation is not weakened; full width lining boards can be securely



CUNO AUTO-KLEAN FILTER (below) part of force-feed lubrication system that saves 25-50% on lubrication costs of Worthington Radial Compressor (left). No mere screen for this filtering job, but a special unit that removes small as well as big particles. Filter is cleaned by a single turn of the handle; needs no renewal cartridge.



Another big reason why Worthington Radial Compressors perform better and longer

Compressed air—for charging brake systems, for general shop service, or many other needs—as quickly as you need it . . . whenever you need it . . . at lowest possible operation and maintenance costs.

Where do you get it?

Users everywhere will tell you that it comes from Worthington Radial Air Compressors. Ask them why these hard-working units give them this economical day-in, day-out performance and they'll give you reason after reason.

Take Worthington's force-feed *filtered* lubricating system with the Cuno Auto-Klean oil filter. Worthington Radials don't depend on a mere small screen to protect moving parts against carbon or other oil contaminants. The Auto-Klean filter removes small as well as large particles, saves 25-50% on lubrication costs, and is just one of the Worthington features that add up to longer life and smoother operation.

Other important features: Worthington's airplane-type connecting rods. Fan cooling of isolated cylinders. Fully counterbalanced crankshaft, ground and polished . . . Timken main bearings . . . the famous Feather* valve. Broad range of capacities: 25-100 hp with piston displacements from 142-538 cfm.

Write for bulletin to Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Vertical Compressor Division, Holyoke, Massachusetts.

*Reg. U. S. Pat. Off.

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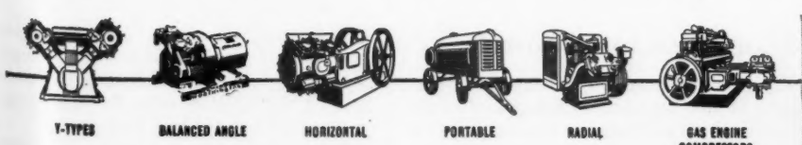


No Other Compressor Will Outperform a Worthington

WORTHINGTON

Compressors

nailed to separate nailers on each side of the anchor.

The guide plate on either side of the anchor has sloping surfaces to guide the steel strapping through the anchor. The anchor itself has rounded edges to prevent damaging the strapping by sharp bends.

◆

Electronic Stethoscope

The Elec-Detec is an electronic instrument designed for use by maintenance men in locating noise sources in bearings, cams, clutches, differentials gears pipe lines, etc. It has been marketed by the Anco Instrument Division American Name Plate & Mfg. Co., Chicago 24.

The device consists of a metal probe, with an electronic amplifier and selector housed in a handy carrying case, and a set of headphones. The metal probe handle contains a microphone that transmits impulses electrically to earphones through the amplifier. Two adjusting knobs on the housing provide volume control and sensitivity.

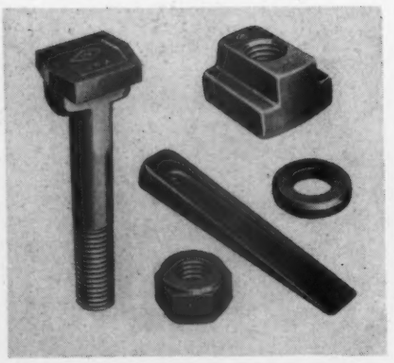
When the probe is placed in contact with a suspected source of noise, the sound vibrations are amplified many hundreds of times so that the exact source of trouble can be pin-pointed immediately. By manipulating the sensitivity control, the operator can identify the sound and analyze its cause.

◆

Machine Set-Up Accessories

In addition to a complete line of strap clamps, J. H. Williams & Co., Buffalo 7, has added T-slot bolts, nuts and flat washers, T-slot nuts and set-up wedges to their line of set-up accessories.

These accessories are used for setting-up work on planers, shapers, milling machines and other similar applications. All are made from a superior grade of steel to



withstand severe machine shop use. Williams T-slot bolts, which it is said, will not turn in machine table or break out machine table slots, are available in ⅜-, ½-, ⅝-, ¾-, ⅞- and 1-in. T-slot sizes in a wide range of lengths.

◆

Grating Spectrograph

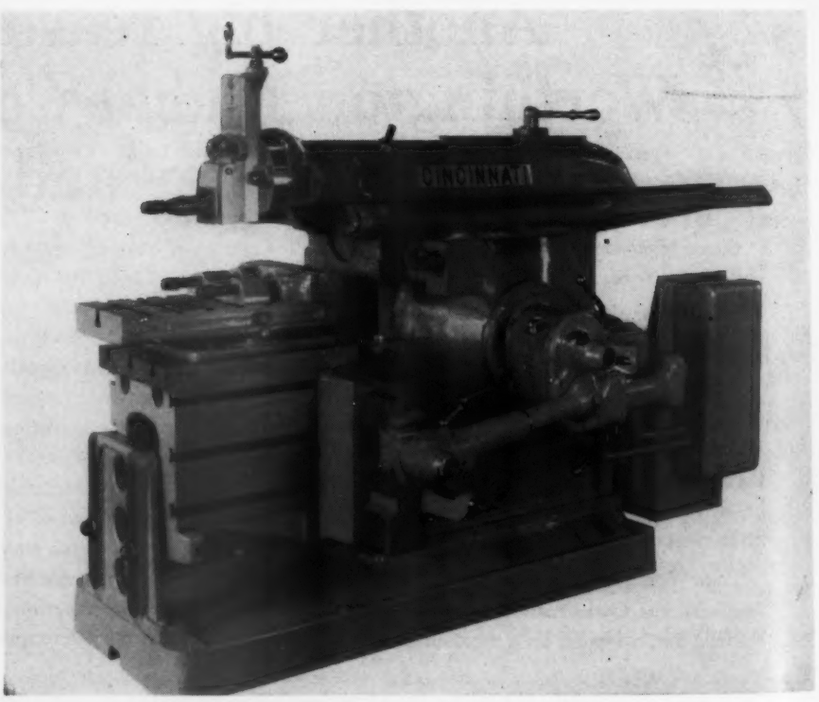
A new device for spectrochemical analysis, the grating spectrograph, which receives the light emitted by a specimen, sorts it into its component wavelengths, and makes a permanent record of the resulting spectrum on film has been introduced by Baird Associates, Inc., Cambridge 38, Mass.

This unit has the ability to perform qualitative and quantitative spectrochemical analysis. It is applicable for railroading work, especially for sludge analysis. In analyzing crankcase sludge of diesel locomotives, significant savings can be obtained according to the instrument's manufacturer.

Periodic checks of engine condition can be ascertained giving precise information as to when a given engine should be overhauled. At intervals, samples of the sludge are removed and reduced to an ash and analyzed by the device.

A correlation of this sludge analysis with data on operating conditions can be valuable in experiments in the study of influence of horsepower on rate of wear, the effect of idling, temperature, fuels, filtration and lubrication on wear.

Made in two designs, the 3-meter unit has an overall length of 15 ft. 8 in., depth of 2 ft. 2 in., and a height of 5 ft. 2 in. The 1-meter unit stands 8 ft 10 in. long, is 2 ft. 11 in. deep, and is 5 ft. 2 in. high. It requires a maximum of 350 watts at 115 volts, 60 cycles.



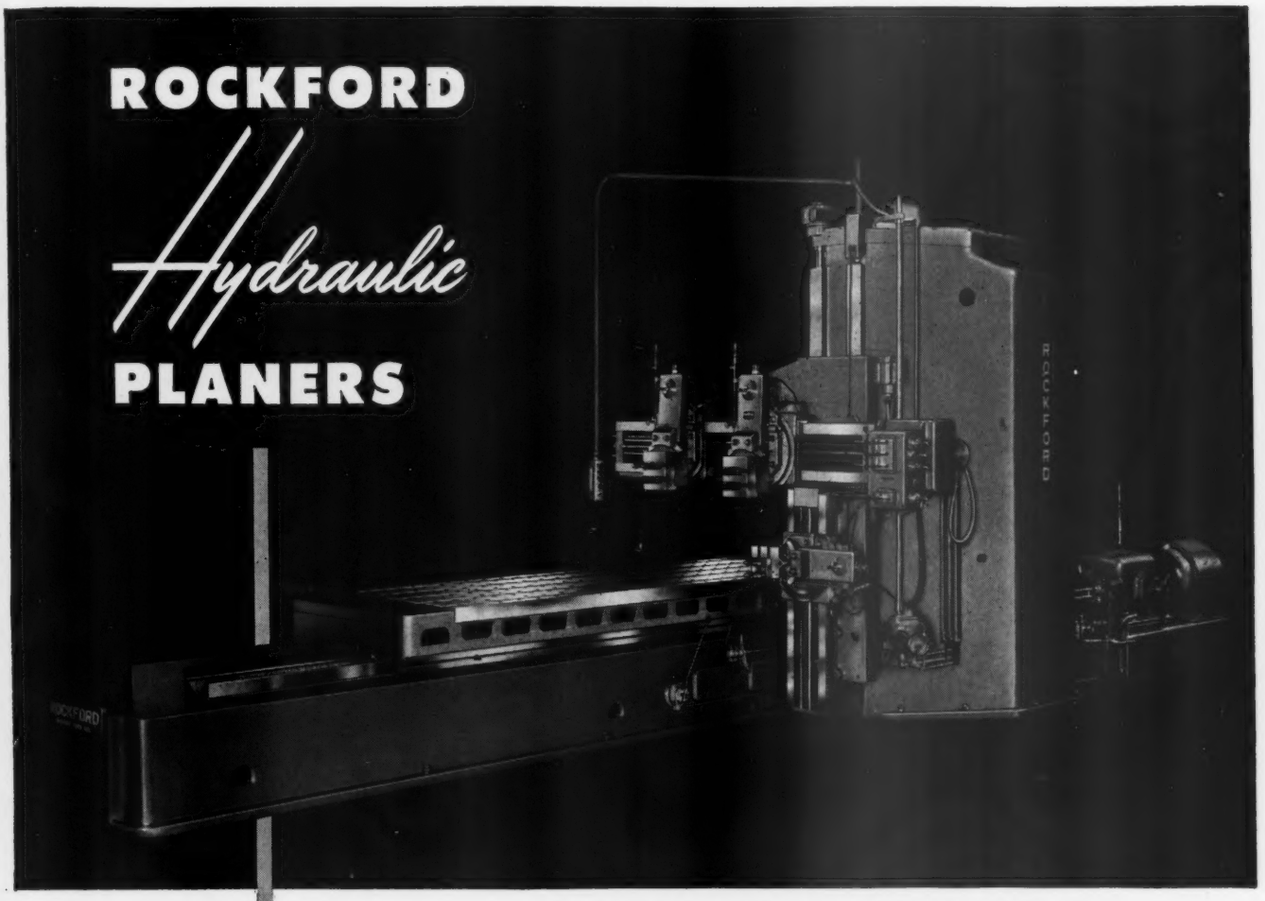
Magnetic Clutch and Brake

The inconvenience and maintenance problems of the old style mechanical clutches and brakes are largely eliminated with the introduction of the electromagnetic clutch and brake. This equipment, manufactured by the Cincinnati Shaper Co., Cincinnati 25, Ohio, is now standard apparatus on its shapers.

This device makes possible instant starting and stopping with a single fingertip control lever. The ram can be positioned quickly for setting tools by the instant action of the clutch and brake.

It operates without a grab. Adjustment of the clutch or brake is not required for the life of the friction surfaces—estimated to be 15 years of normal operation. Torque remains constant throughout operating life.

ROCKFORD *Hydraulic* PLANERS



SIMPLIFIED CONTROLS

HYDRAULIC DRIVE

DESIGN FOR SPEED AND ACCURACY

NEW ANNIVERSARY MODELS FOR GREATER PRECISION, HEAVIER CUTS AND MORE EXTENSIVE USE OF CARBIDE TOOLS

These new Anniversary-Model Rockford Hydraulic Planers are designed and built for maximum production efficiency and use of new types of alloy and carbide cutting tools.

Table, bed and column are newly designed to withstand heavier cutting pressures. New column, with six-foot cross section and increased bearing on bed, assures accuracy.

Exclusive L-type cross-rail construction affords maximum bearing on column with resulting rigidity. Adjustable side-head rail assures accurate and permanent alignment of side head with rail heads.

Be sure to get all the facts on efficiency, ease of handling and new design features of Rockford Hydraulic Planers. Use them as a guide for reduced machining time and costs on all planer work.

Write for Bulletin 450A

Hy-Draulic 523

50th *Anniversary*

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

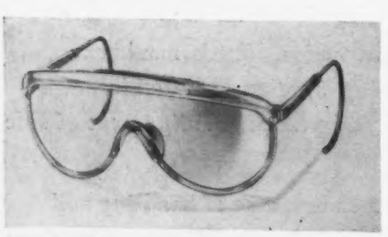
Snap-Around Volt-Ammeter

Pyramid Instrument Corporation, Lynbrook, New York, has announced its Amprobe No. 600, the latest model to be added to its line of snap-around volt-ammeters.

Model "600" combines the six ammeter ranges and three volt-meter ranges in one pocket-size instrument: 0-15/30/60/150/-300/600 amps. a.c. and 0-150/300/600 volts a.c.

Like its predecessors, it measures current instantly without need of interrupting the circuit or shutting down equipment. Six improvements are incorporated. A doughnut-type transformer eliminates, for all practical purposes, the factor of error due to position of conductor within probe jaws. There is fingertip selection for the 9 ranges. The voltage test lead plug is automatically insulated by a snap-out sleeve when removed from meter. Probe jaws completely insulated. There is a high-visibility no-rim window and the instrument is pocket-sized, belt-mounting.

◆

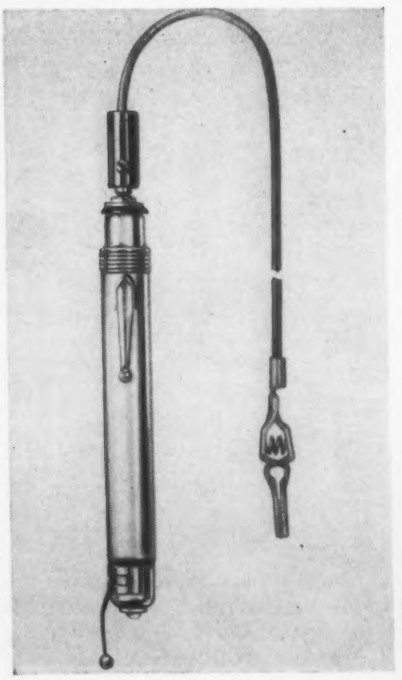


Safety Goggle with Plastic Frame

A safety goggle, featuring a transparent plastic frame which provides a greater field of vision, is announced by American Optical Company, Southbridge, Mass.

The goggle is designed and recommended for wear directly over the eyes or over spectacles. It is particularly useful for frontal protection against foreign particles on machine and hand tool work, chemical and physical laboratory work, spot welding, light grinding, light chipping and light riveting.

◆



Continuity Tester

A pocket-size continuity tester is being added to the line of electricians' tools manufactured by Ideal Industries, Inc., 1561 Park avenue, Sycamore, Ill. It is designed to determine continuity of circuits and identify wires between terminals or in multi-wire cable, as in switchboards and control panels.

The tester permits testing of circuits without the need of live wire connections, as it provides its own power from pen-lite batteries. It may be used in noisy areas, because it uses a signal light indicator which illuminates the point of contact. It requires only one hand, leaving the other hand free to hold circuit diagrams or blueprints. No larger than a pen-lite flashlight, this sturdy little tester will find many uses by electricians, building and plant maintenance men and also on many production lines.

It is equipped with a four-foot cord and alligator clip. When not in use the test lead is detached eliminating any chance of exhausting the batteries.

◆

Molded Glass Laminates

A series of low-pressure laminates have been developed by Dow Corning Corp., Midland, Mich. Molded of glass cloth and silicone bonding resin at pressures from 3 to 30 psi., they will withstand continuous exposure to temperatures in the range of 500 deg. F. and intermittent exposure to as high as 900 deg. F.

These finished laminates with a mechanical strength superior to silicone bonded moldings weigh less than aluminum or magnesium and are stronger than either at 500 deg. F. according to the manufacturer. Smooth and non-porous, they are water repellent and resistant to most commonly used chemicals. Laminating stocks may be performed and used to prepare complex shapes either by bag molding or in light metal molds. Flat sections can be laminated in thicknesses ranging from 0.01 to 2 in.

The organic resins, used in the older manufacturing process were useful only at operating temperatures below 350 deg. F. For service at higher temperatures, the low-pressure silicone-glass laminates were developed by Dow. Press time for these laminates is only 15 min. for an ⅛ in. section.

◆

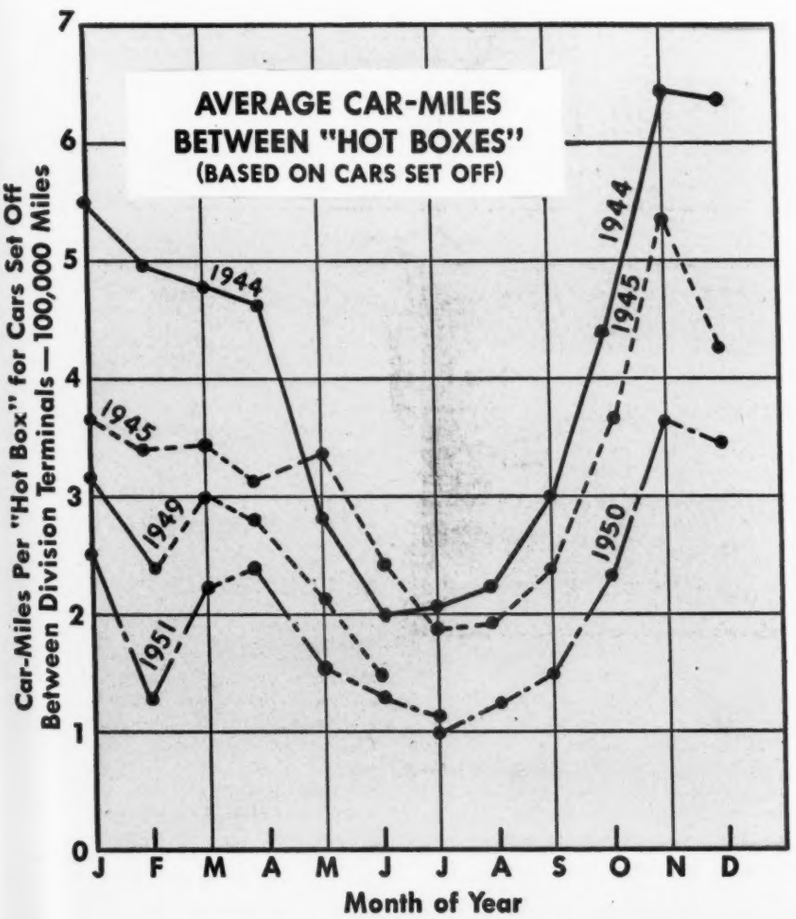
Semi-Automatic Compound Dispenser

A semi-automatic unit for feeding water treatment compounds to locomotive systems has been marketed by The Bares Company Cleveland 3, Ohio.

This system is in reality a safety dispenser. It is located inside the cab of steam and diesel locomotives and is connected to the water circulating system. The necessity for climbing up on the outside of the locomotive to apply compound with the attandant hazards of ladders, unsteady footing, etc., is eliminated.

Called the Safti-Spenser it injects the water treating compound steadily and constantly even when the engine is rolling. Another advantage claimed is in the practical elimination of dermatitis and skin irritation from the treating compounds.

Car-miles per "HOT BOX" hit low point in July



EVERY year for the past seven years the "hot box" problem has been growing steadily worse, A.A.R. records show. And these same records show that the worst month of the year is July, with freight cars averaging only 100,000 car-miles between set-outs for "hot boxes".

So we can expect to see the next thirty days set a new record of train delays, interrupted schedules, damage to lading and costly journal repairs, all due to "hot boxes".

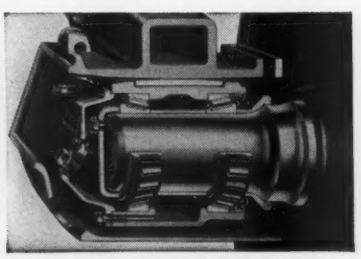
By switching to "Roller Freight"—freight cars with Timken® roller bearings instead of old-style friction bearings—railroads can eliminate the main causes of "hot boxes": 1) waste grab 2) loss of lubricant 3) contamination of lubricant by dirt and water. With Timken bearings there *is* no waste. Highly effective seals permit long-lasting grease lubrication. Lubricant stays *in*—dirt and moisture stay *out*.

"Roller Freight" offers you many other big operating economies. It reduces terminal inspection man-hours 90%. Cuts lube bills up to 89%. Cuts starting resistance 88%, which means jolt-free starts and stops, less damage to lading.

It's estimated that when all railroads go "Roller Freight" they'll save $190 million a year, net a 22% yearly return on the investment! And the cost is low! Complete assemblies of cartridge journal box and Timken bearings for freight cars cost 20% less than applications of six years ago.

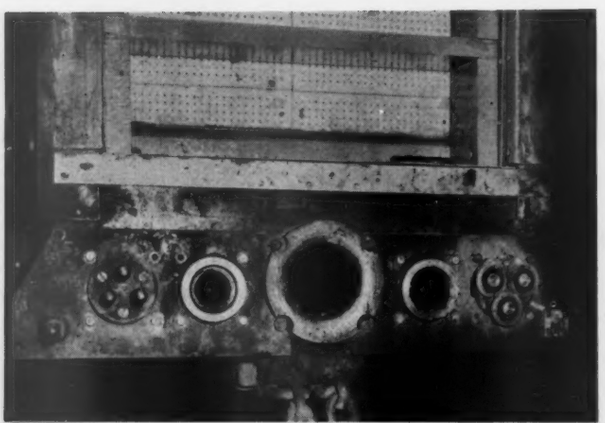
For additional information write The Timken Roller Bearing Company, Canton 6, O. Cable address: "TIMROSCO".

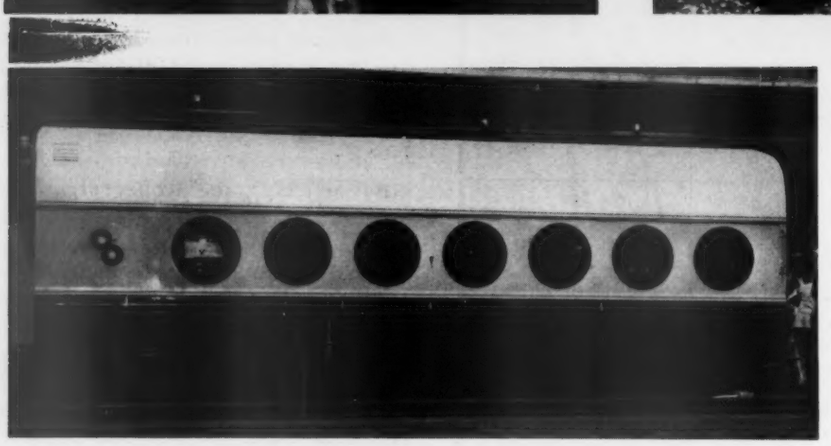
TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

NEWS





Chesapeake & Ohio Unveils "Train X" Car

A SINGLE-AXLE, trailer-type coach, built by the Pullman-Standard Car Manufacturing Company from designs developed by the Chesapeake & Ohio for its experimental "Train X," was displayed to executives of some 15 major United States and Canadian railroads on June 11 in a special run from Detroit to Plymouth, Mich., and return.

The "Train X" car is approximately 31 ft. long, or about one-third the length of a conventional car. The floor is 2½ ft. nearer the rails and the roof is 3 ft. lower. The car is mounted on two rear wheels with a single axle and has a trailer type connection to the car ahead. As shown above it is disconnected from the special adapter car used to couple it to standard locomotives, and the forward end of the car (at right of picture) is supported by dolly wheels.

The experimental car seats 28 passengers. As displayed on June 11, the car is an engineering model and is not finished for regular service. The exposed wiring and various instruments have been installed to determine stresses, ride characteristics, temperature control, etc. The spring suspension design creates a pendulum effect so that the car banks into curves somewhat like a bicyclist, to provide passenger comfort even during high speed operations around curves.

"Train X" cars are designed to couple on impact (two upper pictures). Service lines are connected, valves are opened and couplings are locked by lifting the dolly wheels which carry the front end of a separated car. Lowering the dolly wheels unlocks the coupling, disconnects service lines and closes valves. This method of coupling and uncoupling is said to eliminate manual operations now performed between and under conventional cars. Wheels are rubber centered to lessen noise and permit higher braking ratios, while disk type brakes are installed outside of each wheel for easy access.

Economic studies, the C&O says, indicate that "Train X" in mainline service would save enough to pay for itself in from two to four years. The savings would be derived by reduction of weight to about one-third that of present lightweight equipment, by simplification of mechanical design, and by placing in a single head-end car most of the mechanical equipment now carried under each separate car.

St. Louis Diesel Club Honors H. H. Urbach

H. H. URBACH, general superintendent motive power and machinery, Chicago, Burlington & Quincy, was honored at the May 13 meeting of the St. Louis Railroad Diesel Club by the presentation of its bronze plaque, awarded annually, for outstanding contribution to the development and successful use of diesel motive power in railroad service.

In addressing the meeting following the award, Mr. Urbach recalled the history of the development of diesel service on the Burlington which began with the 600-hp. unit on the "Pioneer Zephyr" which went into service in 1934. This was soon followed by two 3,000-hp. diesels for the "Denver Zephyrs" and two 1,800-hp. diesels for the "Twin Zephyrs." The high availability and trouble-free operation of these locomotives, which averaged up to and over 30,000 miles a month, Mr. Urbach said, proved that diesel power for passenger service was practical and sound. The road now has 103 units for all passenger service, except a few suburban trains for which additional units are to be provided.

Freight diesels, Mr. Urbach said, were first tested on the Burlington in 1937.

Unbeatable for high-voltage use

"U. S." USKORONA-NEOPRENE POWER CABLES offer to the exacting railway industry an unbeatable reliability on overhead and underground high-voltage power applications on circuits up to 8000 volts between phases and at conductor temperatures up to 75° C. They will not crack after 3 hours in air containing .015 per cent ozone. Light in weight, easy to install and join, resistant to oil, heat, sunlight, flame, acids, alkalies and corrosive chemicals. USKORONA-NEOPRENE cables also eliminate electrolysis. In the chart at the right are the guaranteed test values.

PRODUCTS OF U.S.RUBBER SERVING THROUGH SCIENCE

MOISTURE RESISTANCE (Maximum Values)

Dielectric Constant and Power Factor of the insulation after immersion in water at 50° C.: Dielectric Constant, one day is 4.5; per cent gain, 1 to 14 days is 5.0; per cent gain, 7 to 14 days is 2.0; Power Factor, per cent, one day is 3.0; Stability Factor 40-80 volts/mil two weeks, per cent is .5.

PHYSICAL AND AGING PROPERTIES (Minimum Values)

	Uskorona			Neoprene Jacket	
	Unaged	After 96 Hrs. O.B.	After 7 Day Geer Oven	Unaged	After 96 Hrs. O.B.
Tensile Lbs./Sq. In.	500	450	450	1800	1600
Elongation Per Cent	250	200	200	300	250

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE AND CABLE DEPARTMENT • 1230 AVENUE OF THE AMERICAS, NEW YORK 20, NEW YORK

Fifty-eight locomotives (212 units) have since been acquired and assigned in nine different pools. The road also has forty 1,500-hp. general-purpose diesel units equipped with steam generators and dual and multiple-unit control; 150 single units and 14 double-unit road switchers. About 400 steam locomotives remain on the road.

The maintenance of diesel locomotives on the Burlington, he said, has been largely by cut and try methods in two fairly modern running repair shops and one general repair shop. This state of flux, said Mr. Urbach, "presents many questions which the Burlington attempts to answer by means of a diesel committee composed of the superintendent of automotive equipment as chairman and all diesel supervisors on the system as members." This committee keeps before it the present maintenance policy, investigate all new suggestions presented from the field from time to time, and considers what improvements can be made in present maintenance procedures.

N. Y. RR Club To Hold Fourth Essay Contest

"To encourage constructive thought about railroad problems by students of transportation and younger men in railroad employ" the New York Railroad Club has announced its fourth Roy V. Wright Memorial Essay Contest.

Essays may be on "any subject calculated to make for improved railroading"; should be not less than 3,000 nor more than 7,000 words in length; and must be in the hands of C. T. Stansfield, executive secretary of the club, not later than October 15, 1952. There is a first prize of $500 and 10 other awards of $100 each.

Additional information concerning the contest—which is named for the late editor of *The Railway Mechanical and Electrical Engineer* — may be obtained from Mr. Stansfield at 30 Church street, New York 7.

SUMMARY OF MONTHLY HOT BOX REPORTS

Month	Foreign and system freight car mileage (total)	Cars set off between division terminals account hot boxes			Miles per hot box car set off between division terminals
		System	Foreign	Total	
July, 1950	2,745,932,894	.....	.....	23,957	114,619
August, 1950	2,937,455,020	7,422	15,490	22,912	128,206
September, 1950	2,974,297,739	6,541	12,881	19,422	153,141
October, 1950	3,165,997,915	4,343	8,935	13,278	238,439
November, 1950	2,868,871,913	2,536	5,331	7,867	364,672
December, 1950	2,813,042,212	2,278	5,968	8,246	341,140
January, 1951	2,840,847,511	2,870	8,436	11,306	251,269
February, 1951	2,425,226,454	4,528	14,063	18,591	130,452
March, 1951	3,063,173,942	3,667	10,078	13,745	222,857
April, 1951	2,996,562,763	3,702	8,914	12,616	237,521
May, 1951	3,013,634,782	5,631	13,737	19,368	155,599
June, 1951	2,874,873,495	7,074	15,376	22,450	128,057
July, 1951	2,768,920,095	8,886	18,823	27,709	99,929
August, 1951	3,009,371,111	9,023	19,092	28,115	107,038
September, 1951	2,925,570,545	6,472	13,565	20,037	146,008
October, 1951	3,116,490,095	4,131	9,053	13,184	236,384
November, 1951	2,939,503,144	2,022	4,405	6,427	457,368
December, 1951	2,752,316,133	2,130	5,398	7,528	365,611
January, 1952	2,824,298,630	3,208	7,197	10,405	271,437
February, 1952	2,809,162,671	2,723	6,473	9,196	305,477

ORDERS AND INQUIRIES FOR NEW EQUIPMENT PLACED SINCE THE CLOSING OF THE JUNE ISSUE

DIESEL-ELECTRIC LOCOMOTIVE ORDERS

Road	*No. of units*	*Horsepower*	*Service*	*Builder*
Pittsburgh & West Virginia	6[1]	2,000	Road switch	Fairbanks, Morse
Rutland	4[2]	1,600	Road switch	Alco-G. E.

STEAM LOCOMOTIVE ORDERS

Road	*No. of locos.*	*Type*	*Builder*
Norfolk & Western	15[3]	0-8-0	Company shops

FREIGHT-CAR ORDERS

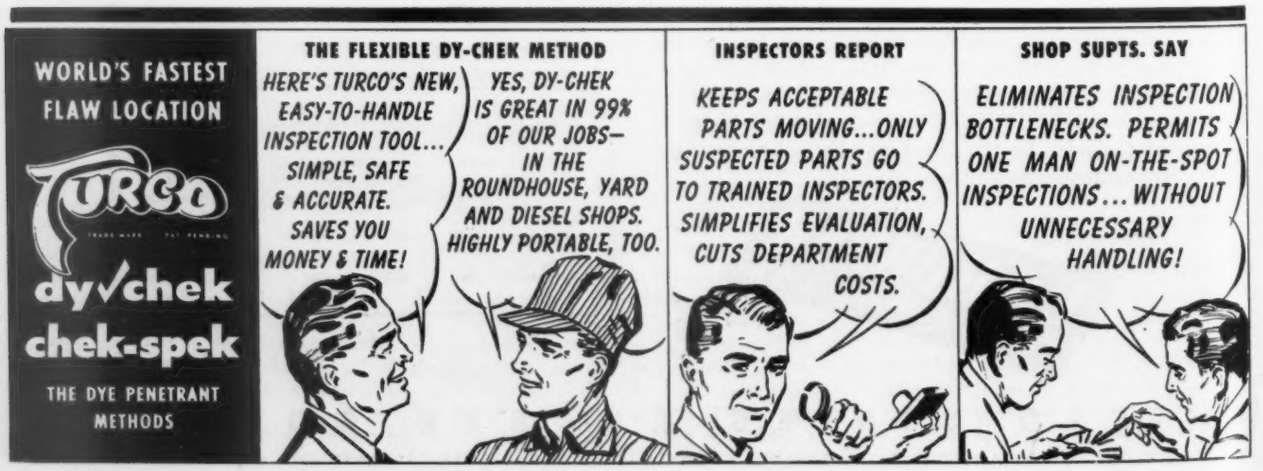
Road	*No. of cars*	*Type of car*	*Builder*
Atlantic Coast Line	12	Air dump	Baldwin-Lima-Hamilton
Norfolk & Western	1,000[3]	70-ton gondola	Company shops
	500	50-ton gondola	Company shops
	25	70-ton flat	Company shops
	500	Box (B8 class)	Pullman-Standard
Tennessee Copper Co.	6	Air dump	Baldwin-Lima-Hamilton
Western Pacific	100	70-ton ballast	Pullman-Standard

PASSENGER-CAR ORDERS

Road	*No. of cars*	*Type of car*	*Builder*
New York, New Haven & Hartford	3[4]	RDC-1	Budd Co.
	3[4]	RDC-3	Budd Co.

[1] Acquisition of these units next February expected to complete dieselixtion of the road. The new units will cost approximately $1,050,000.
[2] All units to be equipped with steam generators.
[3] Construction of the new switchers, which will each have a tractive force of 62,932 lb., will begin in December. Delivery of the Pullman-Standard cars expected next fall.
[4] Estimated cost of the six cars, $960,000. The road is also contemplating the purchase of 11 additional RDC units.

NOTE:
Texas & Pacific.—The board of directors of the T. & P. have authorized the construction of 200 70-ton hopper cars.


WORLD'S FASTEST FLAW LOCATION
TURCO
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THE DYE PENETRANT METHODS
THE FLEXIBLE DY-CHEK METHOD
HERE'S TURCO'S NEW, EASY-TO-HANDLE INSPECTION TOOL... SIMPLE, SAFE & ACCURATE. SAVES YOU MONEY & TIME!
YES, DY-CHEK IS GREAT IN 99% OF OUR JOBS— IN THE ROUNDHOUSE, YARD AND DIESEL SHOPS. HIGHLY PORTABLE, TOO.
INSPECTORS REPORT
KEEPS ACCEPTABLE PARTS MOVING...ONLY SUSPECTED PARTS GO TO TRAINED INSPECTORS. SIMPLIFIES EVALUATION, CUTS DEPARTMENT COSTS.
SHOP SUPTS. SAY
ELIMINATES INSPECTION BOTTLENECKS. PERMITS ONE MAN ON-THE-SPOT INSPECTIONS... WITHOUT UNNECESSARY HANDLING!

SELECTED MOTIVE POWER AND CAR PERFORMANCE STATISTICS

FREIGHT SERVICE (DATA FROM I.C.C. M-211 AND M-240)

Item No.		Month of February		2 months ended with February	
		1952	1951	1952	1951
3	Road locomotive miles (000) (M-211):				
3-05	Total, steam	19,162	24,562	39,842	53,435
3-06	Total, Diesel-electric	25,252	18,014	50,937	38,937
3-07	Total, electric	771	699	1,573	1,536
3-04	Total, locomotive-miles	45,193	43,281	92,361	93,910
4	Car-miles (000,000) (M-211):				
4-03	Loaded, total	1,640	1,509	3,288	3,259
4-06	Empty, total	880	672	1,778	1,525
6	Gross ton-miles-cars, contents and cabooses (000,000) (M-211):				
6-01	Total in coal-burning steam locomotive trains	34,979	40,438	72,266	89,300
6-02	Total in oil-burning steam locomotive trains	8,333	10,399	16,782	22,127
6-03	Total in Diesel-electric locomotive trains	70,542	49,383	139,962	107,057
6-04	Total in electric locomotive trains	2,175	1,900	4,316	4,175
6-06	Total in all trains	116,070	102,147	233,378	222,693
10	Averages per train-mile (excluding light trains) (M-211):				
10-01	Locomotive-miles (principal and helper)	1.04	1.05	1.04	1.05
10-02	Loaded freight car-miles	40.00	39.10	39.30	38.80
10-03	Empty freight car-miles	21.40	17.40	21.20	18.10
10-04	Total freight car-miles (excluding caboose)	61.40	56.50	60.50	56.90
10-05	Gross ton-miles (excluding locomotive and tender)	2,827	2,645	2,786	2,649
10-06	Net ton-miles	1,317	1,252	1,299	1,248
12	Net ton-miles per loaded car-mile (M-211)	33.00	32.00	33.10	32.20
13	Car-mile ratios (M-211):				
13-03	Per cent loaded of total freight car-miles	65.10	69.20	64.90	68.10
14	Averages per train hour (M-211):				
14-01	Train miles	17.40	16.40	17.20	16.50
14-02	Gross ton-miles (excluding locomotive and tender)	48,609	42,743	47,418	43,134
14	Car-miles per freight car day (M-240):				
14-01	Serviceable	46.60	42.30	45.30	44.00
14-02	All	44.50	40.30	43.20	42.00
15	Average net ton-miles per freight car-day (M-240)	954	894	928	920
17	Per cent of home cars of total freight cars on the line (M-240)	40.90	34.40	40.70	34.50
	PASSSENGER SERVICE (DATA FROM I.C.C. M-213)				
3	Road motive-power miles (000):				
3-05	Steam	7,459	10,241	16,212	22,825
3-06	Diesel-electric	17,132	14,041	35,297	30,042
3-07	Electric	1,579	1,429	3,298	3,144
3-04	Total	26,171	25,712	54,810	56,011
4	Passenger-train car-miles (000):				
4-08	Total in all locomotive-propelled trains	259,643	242,875	542,431	535,625
4-09	Total in coal-burning steam locomotive trains	40,165	53,625	86,908	121,351
4-10	Total in oil-burning steam locomotive trains	24,586	29,450	52,157	67,016
4-11	Total in Diesel-electric locomotive trains	177,296	144,976	366,887	314,186
12	Total car-miles per train-miles	9.72	9.33	9.73	9.47
	YARD SERVICE (DATA FROM I.C.C. M-215)				
1	Freight yard switching locomotive-hours (000):				
1-01	Steam, coal-burning	936	1,238	1,956	2,682
1-02	Steam, oil-burning	167	218	341	477
1-03	Diesel-electric[1]	3,061	2,563	6,286	5,521
1-06	Total	4,187	4,043	8,631	8,733
2	Passenger yard switching hours (000):				
2-01	Steam, coal-burning	33	48	71	106
2-02	Steam, oil-burning	11	12	24	27
2-03	Diesel-electric[1]	245	217	510	463
2-06	Total	322	307	671	660
3	Hours per yard locomotive-day:				
3-01	Steam	7.40	8.10	7.40	8.30
3-02	Diesel-electric	17.20	17.30	17.00	17.70
3-05	Serviceable	14.80	14.30	14.70	14.60
3-06	All locomotives (serviceable, unserviceable and stored)	12.80	12.30	12.70	12.60
4	Yard and train-switching locomotive-miles per 100 loaded freight car-miles	1.76	1.85	1.81	1.85
5	Yard and train-switching locomotive-miles per 100 passenger train car-miles (with locomotives)	0.77	0.78	0.77	0.77

[1] Excludes B and trailing A units.

SUPPLY TRADE NOTES

GENERAL STEEL CASTINGS CORPORATION.—*Howard F. Parks, Jr.*, has been appointed manager of sales for the General Steel Castings Corporation, with headquarters at Granite City, Ill., and *Lawrence P. White* has been appointed district manager—sales, at the eastern district sales office at Eddystone, Pa., succeeding Mr. Park.

◆

INDEPENDENT PNEUMATIC TOOL COMPANY.—The Independent Pneumatic Tool Company has inaugurated a new Thor industrial sales division and has made the following appointments, to effect the new division's expansion of the sales department: *J. A. Hill*, manager of industrial sales; *J. F. Corkery*, manager of electric tool sales, to succeed Mr. Hill; and *G. A. Thoma*, sales promotion manager, to succeed Mr. Corkery.

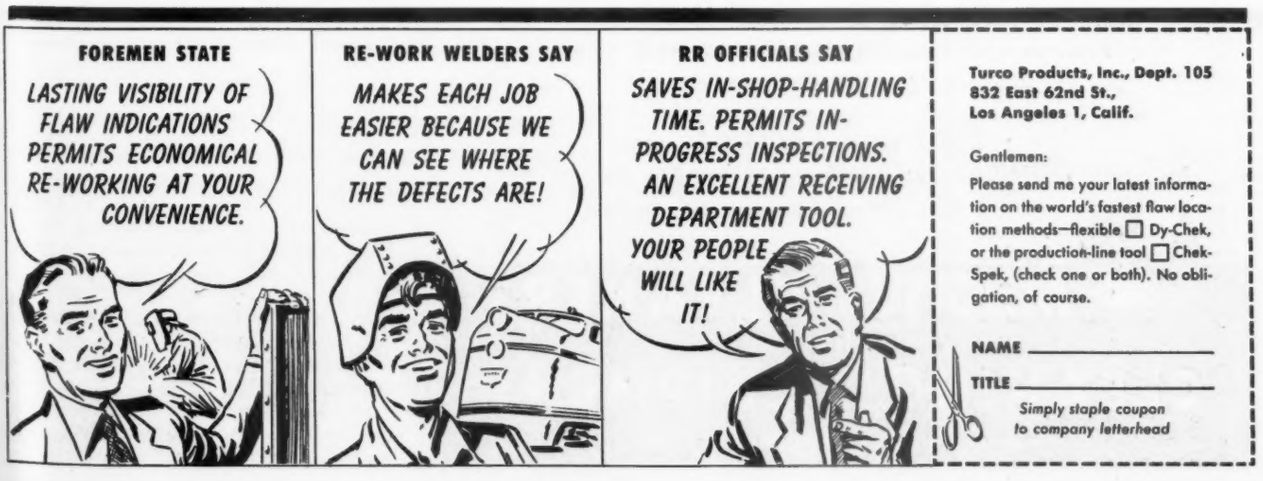
◆

WESTINGHOUSE ELECTRIC CORPORATION.—The Westinghouse Electric Corporation will build a new multimillion dollar plant at Raleigh, N. C., as part of its $296,000,000 expansion program. The plant, more than 500,000 sq. ft. in area and employing 2,500 people, will be for the manufacture of watthour electric meters. Ground will be broken within the next few weeks on a 100-acre site just north of Raleigh. Completion is expected by July 1, 1953.

◆

H. K. PORTER COMPANY.—The *Sales Engineering Company*, Salt Lake City, has been appointed exclusive sales representative in the Mountain states area for the *American-Fort Pitt Spring* division of the H. K. Porter Company.

The *John J. Gillis Company*, 20 Provi-


FOREMEN STATE
LASTING VISIBILITY OF FLAW INDICATIONS PERMITS ECONOMICAL RE-WORKING AT YOUR CONVENIENCE.
RE-WORK WELDERS SAY
MAKES EACH JOB EASIER BECAUSE WE CAN SEE WHERE THE DEFECTS ARE!
RR OFFICIALS SAY
SAVES IN-SHOP-HANDLING TIME. PERMITS IN-PROGRESS INSPECTIONS. AN EXCELLENT RECEIVING DEPARTMENT TOOL. YOUR PEOPLE WILL LIKE IT!
Turco Products, Inc., Dept. 105
832 East 62nd St.,
Los Angeles 1, Calif.
Gentlemen:
Please send me your latest information on the world's fastest flaw location methods—flexible ☐ Dy-Chek, or the production-line tool ☐ Chek-Spek, (check one or both). No obligation, of course.
NAME
TITLE
Simply staple coupon to company letterhead

Stock This ONE

Safe Grease-Dissolving Cleaner...

for these 14 cleaning jobs!

The cleaner is Magnus 5-RR...an especially developed solvent soap for railroad use. Its function is the rapid removal of greasy, oily dirt, using hard or soft water, hot or cold, without hard scrubbing or brushing. On these fourteen cleaning jobs (plus many more) Magnus 5-RR offers you safe, rapid, thorough cleaning...

- Diesel Cabs
- Coach Interiors
- Tile
- Station Toilets
- Diesel Exteriors
- Headliners
- Station Floors
- Station Rest Rooms
- Coach Washrooms
- Coach Floors
- Station Woodwork
- Coach Toilets
- Linoleum
- Station Walls

Harmless to Paint... Easy on the Hands!

Magnus 5-RR is harmless to paint or varnish. And it's easy on the hands as well as the muscles! You dissolve it in water—about a teaspoonful per gallon—and spray, brush or sponge it on the surface to be cleaned. Then rinse or wipe it off... and you have bright, clean, *streakless* surfaces in a mighty short time! 5-RR is one of the most economical cleaners on the market, not only in its own cost, but in the labor it requires to do the cleaning job.

Deodorizes and Disinfects, Too

Magnus 5-RR does an excellent deodorizing job as it cleans, and, in addition, does a good part of any sanitizing work you may require. The same solvent that does such a fast job on grease acts as a very effective disinfectant.

LET US SHIP YOU A DRUM... Try it on as many grease-chasing jobs as you can, for 30 days. At the end of that time, if you are not completely satisfied, we will gladly cancel the invoice!

Railroad Division

MAGNUS CHEMICAL COMPANY • 77 South Ave., Garwood, N. J.

In Canada—Magnus Chemicals, Ltd., Montreal

Magnus CLEANERS AND CLEANING EQUIPMENT

Representatives in all principal cities

dence street, Boston 16, has been appointed exclusive sales representative in New England for American Fort Pitt.

◆

CONSOLIDATED MACHINE TOOL CORPORATION.—*Lester D. Chirgwin*, vice-president of the Farrel-Birmingham Company, Ansonia, Conn., since 1945, has been elected also president of the Consolidated Machine Tool Corporation, Rochester, N. Y., a subsidiary acquired by Farrel-Birmingham in December 1951. Mr. Chirgwin succeeds *Arthur H. Ingle*, president of Consolidated since 1924. Mr. Ingle will remain on the board of directors of both Consolidated and Farrel-Birmingham and continue as corporation consultant.

Lester D. Chirgwin

◆

AMERICAN LOCOMOTIVE COMPANY.—Nearly 100 representatives from 50 railroads in all parts of the United States and Canada attended a recent two-day symposium in Schenectady, N. Y., as guests of the American Locomotive Company. Subject of the symposium was use of the spectrograph in analyzing diesel engine lubrication oil to detect and prevent serious engine trouble. The chairman was H. R. Sennstrom, Alco research and testing engineer, who gave a description of Alco's own spectographic work over the past several years.

A. C. Mengel, chief engineer of Alco, opened the symposium with a report on the development of spectrographic methods. A technical account of Alco's present laboratory and field methods was given by L. L. Nathan, Alco chemical engineer.

Among railroad representatives favoring continued use of spectographic analysis for diesel engine maintenance control were: V. E. Amspacher, chief chemist, Pennsylvania; F. Thomas, assistant to general superintendent of equipment, New York Central; Wade R. Seniff, engineer of tests, Baltimore & Ohio; W. E. Lasky, engineer of tests, Gulf, Mobile & Ohio; C. C. Mugford, assistant engineer of tests, Southern Pacific; Stanley Crane, engineer of tests, Southern; W. F. Sinclair, engineer of diesel equipment, Canadian Pacific, and Kenneth Cartwright, general mechanical superintendent, New York, New Haven & Hartford.

Mr. Seniff summarized the general conclusions of the symposium by saying that while spectrographic analysis had already

shop equipment gives
better, longer service
with

MOLD-CURED
HAZACORD®

Shop equipment and portable tools stay on the job longer and get more work done when Hazacords help. That's because Hazacord is made to stand up under the rigors of rugged shop work. What's the cause of your cord failures . . . oil, grease or chemical attack . . . or just constant physical abuse? For such problems, Hazacord is the answer.

Every foot of Hazacord is *cured under pressure in a continuous metal mold* to provide extra density, lasting toughness and a smooth, wear-resistant surface. No other type of sheath can give you the same protection against chemical attack and mechanical damage.

Examine a length of Hazacord . . . immediately, you'll see the name in raised letters—identifying this *mold-cured* cord. It's your best guarantee of top performance and long cord life. Ask your Hazard representative about Hazacord or write for complete details.

Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZACORD *Mold-Cured* flexible cords

9916

proved itself by progress made during the past year, railroads and manufacturers must capitalize on use of spectrography as a vital tool which brings good dividends if accurately and intelligently used. He proposed, as a resolution, that railroads and manufacturers form a committee, headed by Mr. Amspacher, to determine standard laboratory techniques and tolerances for formal submission to the American Society for Testing Materials, which would then establish spectrographic standards for the railroad and locomotive industries.

◆

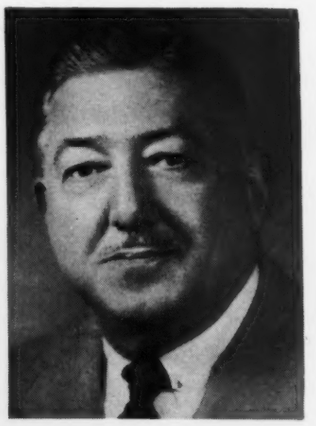
MINNEAPOLIS - HONEYWELL REGULATOR COMPANY.—*Charles Sanders,* formerly western sales manager for the transportation division of the Minneapolis-Honeywell Regulator Company, at Chicago, has been appointed sales manager of the division to succeed *Maurice R. Eastin,* who has resigned. *Earle Barker,* associated with the transportation division for the past five years, has been appointed eastern sales manager. Mr. Sanders, with new headquarters in Minneapolis, will direct sales of control equipment for railway cars, diesel locomotives, streetcars, subway cars and buses.

◆

NATIONAL MALLEABLE & STEEL CASTINGS CO.—*Robert D. Sowers* has been appointed sales manager of the industrial division at the Sharon Works of the National Malleable & Steel Castings Co., to replace *Paul E. Tamplin,* deceased. Mr. Sowers, who joined National Malleable in 1936, has been with the railway division at the Cleveland general office for the past year.

◆

VANADIUM CORPORATION OF AMERICA.—*Harry E. Orr,* formerly assistant vice-president and manager of district sales for the



H. E. Orr

Vanadium Corporation of America, has been appointed assistant vice-president and manager of engineering sales, with headquarters at Chicago. *John B. Girdler,*

J. B. Girdler

formerly regional manager at the Pittsburgh office, has been appointed corporation sales manager, with headquarters in New York.

◆

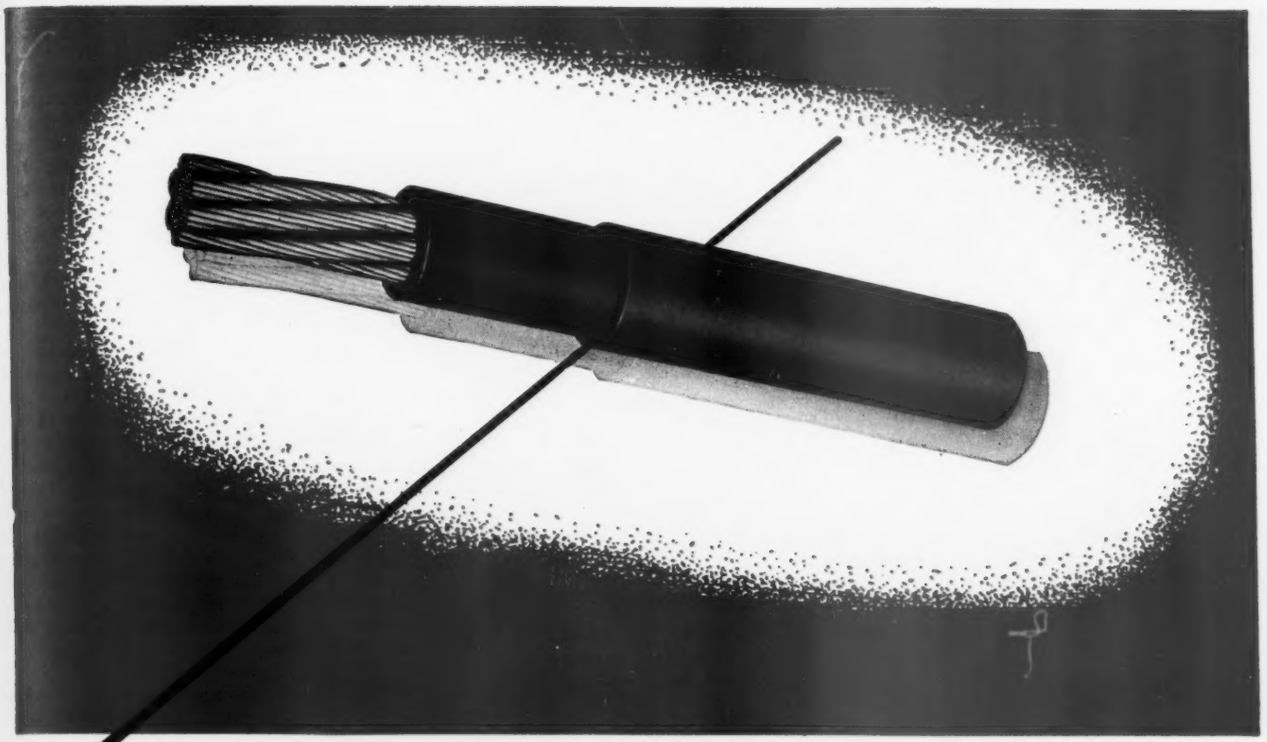
HUNT-SPILLER MANUFACTURING CORPORATION.—*Frank A. Messick,* formerly with the mechanical department of the Louisville & Nashville, has joined the Hunt-Spiller Manufacturing Corporation as its representative in the southeastern states.

◆

GENERAL MOTORS PRODUCTS OF CANADA.—The Diesel Engine Sales division of General Motors Products of Canada has been moved from Oshawa to General Motors Diesel, Ltd., at London, Ont. The transfer is part of the policy of combining Canadian sales and distribution of G. M. diesel products at the London plant.

Under *Norman H. Daniel,* manager of the Diesel Engine Sales division at Oshawa, the entire staff of 15 persons has been

Through the Rockies...
357
357
FELPAX Lubricators help keep the "Empire Builder" on schedule
From the first turn of the wheels in Chicago, through the rugged Rockies to Seattle and back again, the suspension bearings on G.N's. "Empire Builder" get full, continuous lubrication with modern FELPAX LUBRICATORS! Special felt wicks, that last thousands of miles, eliminate waste grabs and starved bearings caused by old fashioned yarn packing.
You can solve *your* suspension bearing lubrication problems, too, with FELPAX LUBRICATORS.
For full information on Modern FELPAX Lubricators see your locomotive builder or write to:
the lubricator that eliminates repacking
MILLER FELPAX LUBRICATOR
MILLER FELPAX CORPORATION
WINONA, MINNESOTA



There's Double Satisfaction in this car wire.

Yes, when you specify Simplex-Anhydroprene Wires for car lighting, heating, and air conditioning circuits, you'll smile, and so, too, will your passengers.

You'll acclaim their low cost, dependable performance, and long life. Your passengers will cheer the constant "at-home" comfort their failure-free operation provides. All spell p-r-o-f-i-t for you.

Insulated with Anhydrex and jacketed with a thin — but tough — wall of neoprene, Anhydroprene wires combine stable electrical properties with effective resistance to water and moisture, oils, grease, acids, heat and flame. They have no outer braids to fray and rot and hold in moisture. They are not harmed by vibration or by stray electrical currents. Their light weight, small diameter, and flexibility assure fast, easy installation, and their smooth jacket surface permits pulling through conduits without the use of lubricants.

Anhydroprene Wires are also ideal for diesel wiring and shop wiring, and for power and lighting circuits in yards and stations when the circuits are installed in ducts. If you would like a sample of this top-quality, low-cost wire, plus detailed information, simply fill in and return the coupon below to the Simplex Railroad Department.

SIMPLEX

WIRES AND CABLES

SIMPLEX WIRE & CABLE CO.

79 Sidney St., Cambridge 39, Massachusetts

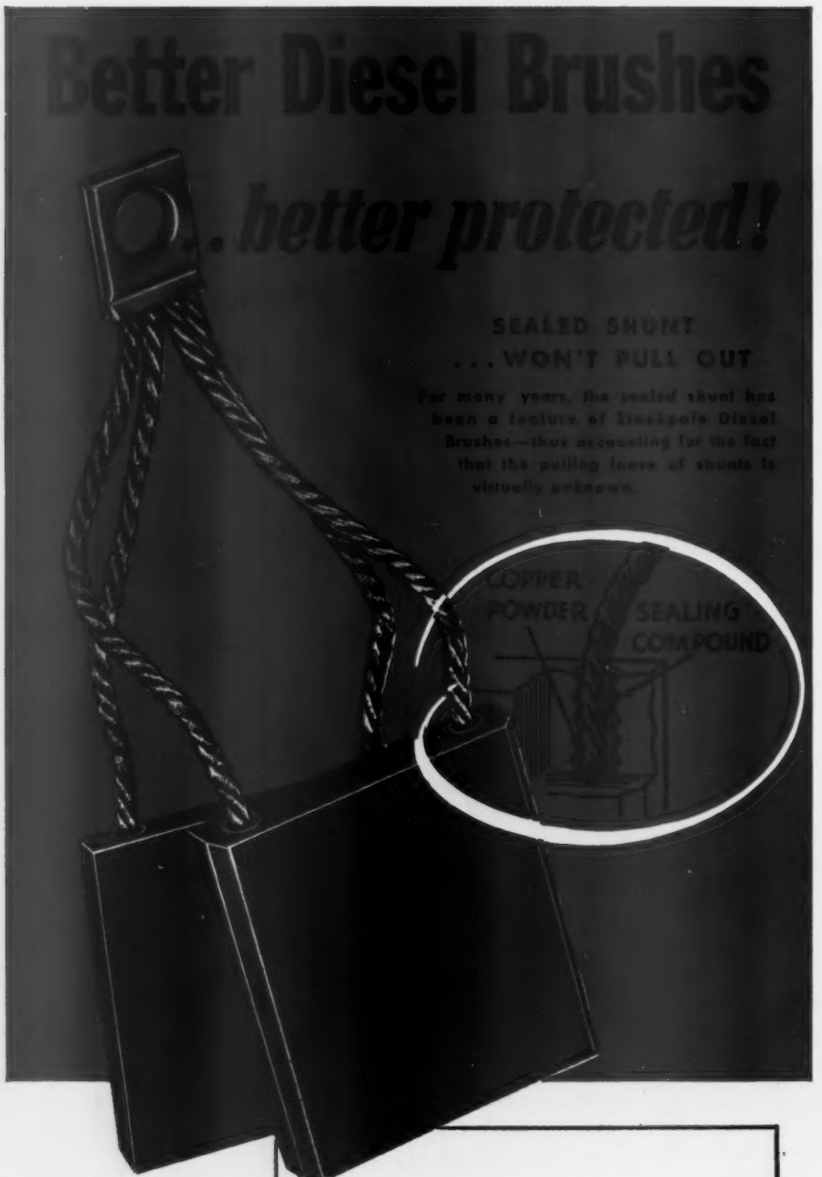
SIMPLEX WIRE AND CABLE CO.
RAILROAD SALES DEPARTMENT
79 SIDNEY ST., CAMBRIDGE 39, MASS.
GENTLEMEN: PLEASE SEND SAMPLE AND BULLETIN 115 TO:

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____


Better Diesel Brushes
. . better protected!
SEALED SHUNT
. . . WON'T PULL OUT
For many years, the sealed shunt has been a feature of Stackpole Diesel Brushes—thus accounting for the fact that the pulling loose of shunts is virtually unknown.
COPPER POWDER
SEALING COMPOUND

From raw materials to finished product, every Stackpole brush is QUALITY CONTROLLED for top-notch on-the-job performance.

STACKPOLE CARBON COMPANY
St. Marys, Pa.

STACKPOLE

BRUSHES FOR ALL ROTATING ELECTRICAL EQUIPMENT • BEARING MATERIALS BRAZING FURNACE BOATS • CARBON PILES • CLUTCH RINGS • CONTINUOUS CASTING DIES • DASH POT PLUNGERS • FRICTION SEGMENTS • RAIL BONDING MOLDS • RESISTANCE WELDING AND BRAZING TIPS • SEAL RINGS • TROLLEY AND PANTOGRAPH SHOES . . . *and dozens of carbon-graphite specialties.*

assigned to General Motors Diesel, Ltd. It includes *Russell Gage*, sales manager of the division; *R. William McEachran*, parts and service manager; and a field force including district sales managers at Vancouver, Edmonton, Toronto, Cornwall, Montreal, and Moncton, N. B. Mr. Daniel has been appointed director of sales of the new Engine Sales division, and *William M. Warner*, assistant to president of G. M. D. since its formation in 1949, has been appointed assistant director of sales.

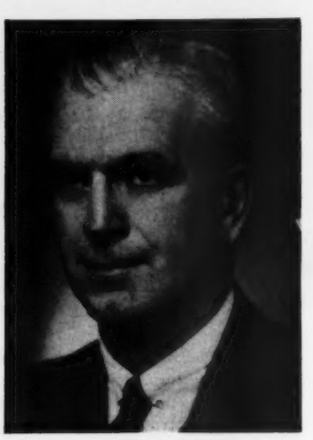
◆

INTERNATIONAL NICKEL COMPANY.—*Ransom Cooper, Jr.*, formerly assistant sales manager of the International Nickel Company, has been appointed manager of the department and *H. D. Tietz*, formerly assistant to the manager of the Inco Nickel alloys department, has been appointed manager of that department. Mr. Cooper and Mr. Tietz will function under Walter C. Kerrigan and L. R. Larson, who, as general sales manager and assistant general sales manager, respectively, are responsible for both primary nickel and mill product sales.

◆

AMERICAN CAR & FOUNDRY CO.—*Thomas C. Ballou* has been appointed district sales manager of American Car & Foundry's New York sales district, in charge of railroad car and miscellaneous sales in New York, New Jersey, New England and Eastern Canada.

Mr. Ballou, who will report directly to F. H. Norton, vice-president in charge of sales, was educated in the Cleveland Heights, Ohio, schools, and is a graduate of Western Reserve University. He was



Thomas C. Ballou

employed by the Canton Tank Car Company of Cleveland before joining the A.C.F. sales staff in that city in 1936. Mr. Ballou later was transferred to the New York sales office, specializing in railroad car and welded products sales. He was appointed sales agent in 1948 and district sales representative in New York in October 1951. During World War II Mr. Ballou was a lieutenant in the U. S. Naval Reserve, much of which service was in the European theatre of operations.

◆

OCTAGON PROCESS INC.—*Paul Mezick* has been appointed district sales manager of Octagon Process Inc. for the State of Pennsylvania.

Go easy on the Commutator

with

NATIONAL

TRADE-MARK

Carbon Brushes

for Diesel-Electric

Main Generators

There are far more "National" Carbon Brushes on Diesel-Electric locomotive main generators than *all other makes combined!*

Behind this overwhelming preference for "National" Main Generator brushes is their proved ability to *produce* and *maintain* perfect commutator surface under all *ordinary* operating conditions . . . and to *minimize* commutator wear, bar-burning and copper-dragging under the most *difficult* conditions.

Give costly generator maintenance the brush-off with "National" brushes . . . specifically designed for maximum commutator mileage and efficiency, while combining superior mechanical and electrical properties to assure lasting and dependable brush service.

LOW LIGHT BILLS...

... mark phenomenal acceptance of "EVEREADY" No. 1050 Industrial Flashlight Batteries by a broad cross-section of industry. Delivering twice the usable light of any battery we've ever made before, it will not swell, stick, or jam in the flashlight... has no metal can to leak or corrode.

WRITE FOR BULLETIN CP-2426—"NATIONAL" STANDARDIZED BRUSHES

BUY NATIONAL STANDARDIZED BRUSHES FOR MOST EFFICIENT MOTOR AND GENERATOR OPERATION.

The terms "National", "Eveready", the Three Pyramids device and the Silver Colored Cable Strand are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.
District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco
In Canada: National Carbon Limited, Montreal, Toronto, Winnipeg

IN THE LONG RUN—

The Least Expensive ... Most Effective Mountings You Can Buy! LORD, *of course!*

The use of Lord Mountings and Bonded-Rubber Parts in every field of automotive transportation results in longer service life and greater economy of operation. And as a bonus . . . Lord Mountings improve operator and passenger comfort. Hundreds of Designers and Engineers of transportation equipment have consulted profitably with Lord Engineers for experienced and field-proved advice in isolating shock and vibration. They draw from over 27,000 Lord Vibration-Control Mountings designed to meet specific requirements.

If you manufacture any of the following transportation equipment or supply component parts or assemblies, Lord Engineering can help you:

Railway Cars and Locomotives . . . Trucks and Buses . . . Airframes and Aircraft Engines . . . Earthmoving, Farm and Road Machines . . . Air Compressors . . . Air Conditioners . . . Engine Generator Sets . . . Communication and Signal Equipment.

Lord Mountings are protecting the performance of many more transportation units.

FOR CONSULTATION WRITE OR CALL—

BURBANK, CALIFORNIA
Joe B. Hartley
George E. Behlmer
233 South Third Street
ROckwell 9-2151
CHarleston 6-7481

CHICAGO 11, ILLINOIS
Robert T. Daily
Kenneth L. Hanson
Perry C. Goodspeed, Jr.
520 N. Michigan Ave.
Michigan 2-6010

DALLAS, TEXAS
Bruce O. Todd
1613 Tower Petroleum Building
PRospect 7996

DAYTON 2, OHIO
W. Webster Dalton
238 Lafayette Street
MIchigan 8871

DETROIT 2, MICHIGAN
Everett C. Vallin
7310 Woodward Ave.
TRinity 5-8239

NEW YORK 16, NEW YORK
Vincent Ellis
Jack M. Weaver
280 Madison Avenue
MUrray Hill 5-4477

PHILADELPHIA 7, PENNSYLVANIA
George P. Harrington
725 Widener Building
LOcust 4-0147

ERIE, PENNSYLVANIA
Paul E. Dailey
Harry C. Sapper
1635 West 12th Street
2-2296

LORD MANUFACTURING COMPANY • ERIE, PA.

LORD BONDED RUBBER

HEADQUARTERS FOR
VIBRATION CONTROL MOUNTINGS
. . . BONDED RUBBER PARTS

SAFETY CAR HEATING & LIGHTING CO.—*Harold F. Kneen* has been elected director and vice-president of the Safety Car Heating & Lighting Co., with headquarters at the Hamden, Conn., plant. Mr. Kneen formerly was manufacturing vice-president

Harold F. Kneen

and a director of the Lincoln Electric Company of Cleveland, with whom he had been associated since 1929. He is a graduate of Cornell University (1925) with an engineering degree. He received a master's degree in 1933.

◆

AMERICAN STEEL FOUNDRIES.—*Goff Smith*, sales engineer in the New York office of American Steel Foundries, has been granted a leave of absence to attend the School of Industrial Management of the Massachusetts Institute of Technology, under a fellowship award of the Sloan Foundation program. *John M. Whalen*, associated with the Army Transportation Corps, has joined the sales staff as mechanical assistant.

◆

MAGNAFLUX CORPORATION.—*Hamilton Migel*, second vice-president and eastern manager of the Magnaflux Corporation, has been appointed to the newly created posi-

Blackstone Studios

Hamilton Migel

tion of second vice-president in charge of engineering at Chicago. *Roy O. Schiebel, Jr.*, midwest manager at Chicago, has been transferred to New York as eastern manager. *Kermit A. Skeie* succeeds Mr. Shiebel as midwest manager at Chicago.

UNION CARBIDE & CARBON CORP.—*Thomas D. Cartledge* has been appointed president of *Linde Air Products Company*, a division of Union Carbide and Carbon Corporation. Mr. Cartledge has been senior vice-president of Linde Air Products Company, and a director and vice-president of Dominion Oxygen Company, Limited, a Union Carbide subsidiary.

Mr. Cartledge was born in Jefferson, Ga., and attended Erskine College in South Carolina. He entered the United States Navy as an enlisted man at the beginning of World War I and rose through the ranks to lieutenant (j.g.). Upon leaving the service, he was employed by Linde as a salesman, assigned to a Cleveland territory. Within a short while, Mr. Cartledge was appointed district manager in Kansas City, and later he was district manager in Dallas. In 1925 he was transferred to Linde's general sales management staff in New York, and later became manager, gas sales. After holding the position of assistant general sales manager and general sales manager, in 1940 he was elected vice-president. Four years later he became senior vice-president, director and a member of the executive committee of the Linde company.

Thomas D. Cartledge

Kenneth I. Thompson, who has been appointed vice-president-sales of the Oxweld Railroad Service Company, a division of Union Carbide & Carbon, as announced in the June issue, entered the industrial equipment business in 1921 with the Pennsylvania Pump & Compressor Co. and later worked for the Lehigh-Fuller Company. In 1937 he was associated with Ingersoll-Rand and in 1945 he joined Oxweld Railroad Service as eastern sales manager. Mr. Thompson was appointed general manager in 1950, with headquarters in Chicago.

◆

VAPOR CAR HEATING COMPANY.—*W. J. Burrows* has become associated with the Vapor Car Heating Company, Ltd., of Montreal. Mr. Burrows formerly was with the Canadian National in its electrical and diesel engineering department. *L. D. Hassal* has been transferred from Montreal to Calgary, Alta., to be in charge of Vapor Car Heating service for railroads in that area.

◆

TOWNSEND COMPANY.—*Edward C. Sterling, Jr.* has been appointed western division sales manager of the Townsend Company, with headquarters at the Cherry Rivet division offices in Los Angeles, to succeed *Edward H. Stau*, who has resigned.

◆

GENERAL ELECTRIC COMPANY.—*Frank J. Staroba*, formerly midwestern district manager of the Carboloy department of the General Electric Company, has been appointed field sales manager, with headquarters at Detroit. *L. L. DeCoster*, formerly sales engineer in the Indianapolis and Chicago areas, has been appointed midwestern district manager at Chicago. *L. W. Ballard* has been appointed manager of transportation sales, apparatus sales office, Philadelphia.

L. W. Ballard

Mr. Ballard joined G.E. as a student engineer on the company's test program at Schenectady, N. Y., after graduating in 1935 from the University of Virginia with a B.S. degree in electrical engineering. He was transferred to the quotation division of the company's Philadelphia office in 1937, and in 1939 was named control specialist for the company's Atlantic district. In 1946, he was appointed sales engineer handling steel accounts. For the past five years he has been contacting railroads in the Philadelphia area.

◆

DUKANE CORPORATION.—The Bogue Railway Equipment division of the *Bogue Electric Manufacturing Company*, has been appointed authorized distributor for DuKane Corporation sound products. The Bogue concern will distribute DuKane intercommunication and sound equipment to the railroad industry on a national scale, along with railway products manufactured by Bogue.

◆

JOSEPH DIXON COMPANY.—*John B. Van Why* has been appointed sales representative in the Connecticut, Rhode Island and western Massachusetts area for the Joseph Dixon Company, Jersey City, N. J. Mr. Van Why will handle Dixon Silica-Graphite paints and Dixon graphite and graphited lubricants.

◆

FARR COMPANY.—The Farr Company, of Los Angeles, has appointed four new representatives, as follows: *Donald Southard* of

CRANKSHAFT GRINDING SERVICE

Established 1924 . . . 27 years experience grinding crankshafts! The most complete engine rebuilding shop in the Southwest!

★ HARD CHROMIUM PLATING SERVICE
★ IRON PLATING SERVICE
★ MAGNAFLUX SERVICE

Four machines giving range from the smallest up to crankshafts with stroke of 16" and 200" O.A.L. Complete grinding service for locomotive, stationary, marine, automotive and compressor crankshafts. Damaged journals restored to size by iron plating and hard chromium finish plating.

NATIONAL WELDING & GRINDING CO. 2929 CANTON ST. DALLAS 1, TEXAS

Denver, to cover Colorado and Wyoming; the *F. W. Jenike Company*, Cincinnati, for the Cincinnati trading area and Kentucky; the *Charlie Wood Company*, Columbus, Ohio, for the Columbus, Dayton, Mansfield and Coshocton trading areas; and the *William M. Shank Company*, Indianapolis, to cover southern Indiana.

◆

JOURNAL BOX SERVICING CORPORATION.—*Joseph M. McNamara* has been appointed general manager of the Journal Box Servicing Corporation at Indianapolis, Ind.

◆

DEARBORN CHEMICAL COMPANY.—*Leo E. Flinn* has been appointed sales manager of rust preventives for the Dearborn Chemical Company.

◆

BOWERS BATTERY & SPARK PLUG CO.—*R. M. Jaccard* has been appointed sales manager, industrial division, Bowers Battery & Spark Plug Co., Reading, Pa. Mr. Jaccard will be in direct charge of sales of all batteries for industrial trucks, diesel and mine locomotives, railroad lighting and similar installations.

◆

FANSTEEL METALLURGICAL CORPORATION.—*Dr. Frank H. Driggs*, executive vice-president of Fansteel Metallurgical Corporation, has been elected president of Fansteel and the subsidiary Weiger Weed & Co. *Glen Ramsey*, general manager of the rectifier-capacitor division of Fansteel, has been elected vice-president.

◆

H. K. PORTER COMPANY.—The *Quaker Rubber Corporation* division of H. K. Porter Company, Philadelphia, has established a branch warehouse and sales office at 430 South Mill street, Lockland 15, Cincinnati. The new branch is under the supervision of *W. W. Hutchinson*, who formerly covered the Toledo territory.

Obituary

ANTHONY G. DOHM, vice-president in charge of sales for the Camel Company of Chicago, died May 31 in his home in Chicago.

JOHN A. MACMILLAN, director and former president and chairman of the board of the Dayton Rubber Company, Dayton, Ohio, died on June 7.

APEX INSERTED-BLADE METAL-CUTTING TOOLS

FOR LOCOMOTIVE AND CAR MAINTENANCE

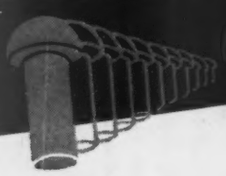
Adjusted Serrated Style

One of many types of railroad shop cutting tools available promptly from stock.

WRITE FOR CATALOG

APEX TOOL & CUTTER CO., Shelton 21, Conn.

PROPERLY HEATED RIVETS at a SAVING!



with a JOHNSTON RIVET FORGE!

AVAILABLE WITH SEMI-PNEUMATIC TIRES.

The Johnston Rivet Forge is outstanding for its ability to hold adjustment and operate steadily without attention. It's available either with steel wheels or equipped with semi-pneumatic tires that absorb vibration and roll along smoothly.

Write for Bulletin R-801!

Over Thirty Years Experience in Design and Manufacture of Burners • Blowers • Furnaces • Rivet Forges • Fire Lighters • Tire Heaters • And Allied Equipment

THE JOHNSTON LINE

JOHNSTON MANUFACTURING CO.
2825 EAST HENNEPIN AVE
MINNEAPOLIS 13, MINN.

ENGINEERS & MANUFACTURERS OF INDUSTRIAL HEATING EQUIPMENT

PERSONAL MENTION

Baltimore & Ohio

O. B. CAPPS appointed mechanical inspector at Baltimore.

KENNETH K. KESSLER appointed engineer of physical tests.

Canadian National

E. J. COOKE, superintendent Transcona, Man., appointed assistant general superintendent car equipment, Central region, with headquarters at Toronto.

W. G. PALMER, assistant general superintendent car equipment, Central region, at Toronto, has retired.

Chesapeake & Ohio

C. D. ALLEN appointed superintendent motive power, with headquarters in Richmond, Va. Former position of assistant superintendent motive power abolished.

B. J. RUCKER appointed assistant superintendent of the car department at Richmond, Va. Former position of chief car inspector abolished.

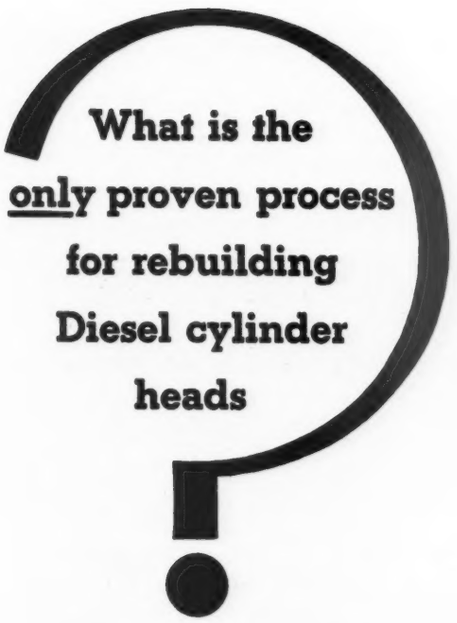
J. C. SMITH, assistant shop superintendent at Huntington, W. Va., appointed general master mechanic at Clifton Forge, Va.

L. H. BOOTH, master mechanic at Peru, Ind., appointed general master mechanic at Huntington, W. Va.

W. S. C. BURWELL, master mechanic at Stevens, Ky., appointed master mechanic at Russell, Ky.

Erie

CHARLES F. SCHWARTZ, master mechanic at Jersey City, N. J., appointed general



THIS is an abstract from a report on the subject presented by two experts* before the American Welding Society:

"There appears to be no record of experience that would justify a departure from the long-established requirement for preheating and annealing, when welded cast iron parts are to be subjected to such severe conditions and changes in temperature as those for a Diesel head."

This is precisely the process used by RALPH STARK, INC. . . . based on over twenty years experience trying *all* processes.

No one is better equipped than STARK to rebuild Diesel heads this way —the only proven way. We have specially designed ovens built for just this purpose. In these scientifically regulated ovens, exclusive with STARK, every head is preheated and annealed, resulting in perfect fusion and elimination of internal strains and stresses.

STARK preheating and annealing ovens are just one example of the many exclusive advantages that STARK rebuilding offers. More than half a million STARK-rebuilt Diesel cylinder heads have given new part performance throughout the country — a record unmatched in the industry.

STARK production methods and equipment are the result of more than 20 years accumulated know-how in precision rebuilding of cylinder heads for long years of hard service. Valve seats are built up with a special Chrome Nickel Alloy, developed exclusively for this purpose and used *only* by STARK. Chrome Nickel Alloy valve seats require far less regrinding, last longer, and result in substantial savings on Diesel maintenance costs.

Built-up valve seats are machined with precision cutters for true accuracy. All machining is done with special tools, cutters, and templates to original specifications. Surfaces are finished by grinding machines designed for the specific job. STARK craftsmen have been intensively trained for the STARK rebuilding process. *No plant in the world* can give you more dependable rebuilding at such low cost.

STARK guarantees equal-to-new efficiency. Send us a trial order of your cracked Diesel cylinder heads for rebuilding. Then examine and test the rebuilt heads. If you are not satisfied, there will be no charge. Or write for further details and information about the STARK rebuilding process and how it can mean large savings in your maintenance costs.

RALPH STARK
INCORPORATED
43-12 THIRTY-THIRD STREET
LONG ISLAND CITY, N.Y.

*La Motte Grover, Welding Engineer, and R. L. Rex, Superintendent of Railroad Service, both of Air Reduction Company.

master mechanic, with headquarters at Jersey City. Territory extended to include Port Jervis, N. Y., and Avoca, Pa.

EARL BRANNING, master mechanic at Hornell, N. Y., appointed general master mechanic, with headquarters at Hornell.

JOHN H. RAY, assistant electrical engineer, appointed electrical engineer at Cleveland.

FRANCIS D. DUNTON, master mechanic at Meadville, Pa., appointed master mechanic at Jersey City, N. J. Position of master mechanic at Meadville abolished.

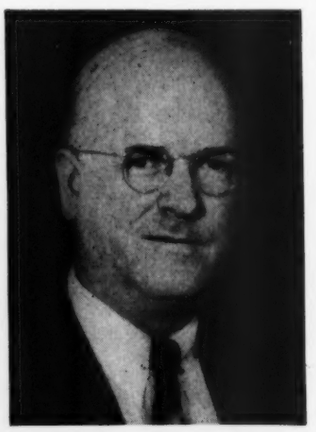
FRANK REVANA, master mechanic at Cleveland, Ohio, has had territory extended to include Meadville, Pa.

FRANCIS D. KENNEDY, master mechanic at Buffalo, has had territory extended to include Salamanca, N. Y., and Jamestown, and Bradford, Pa., and Brockway.

CARL E. MAAHS, master mechanic at Port Jervis, N. Y., appointed master mechanic at Hornell, N. Y. Position of master mechanic at Port Jervis abolished.

DAVID M. HUGGINS has been appointed assistant master mechanic at Cleveland, Ohio.

GORDON E. MCKINNEY, electrical engineer at Cleveland, appointed chief electrical engineer, with headquarters at Cleveland.



Gordon E. McKinney

CHARLES M. STUBBS appointed assistant master mechanic at Marion, Ohio.

St. Louis—San Francisco

With the removal of Southern division headquarters from Memphis, Tenn., to Amory, Miss., the office of master mechanic was transferred to Amory, but that of the general car foreman remained at Memphis.

C. O. YOWELL appointed roundhouse foreman at Pine Bluff, Ark. Position of assistant roundhouse foreman abolished.

J. H. LEE appointed roundhouse foreman at Pine Bluff, Ark. Position of backshop foreman abolished.

C. E. FISHER appointed roundhouse foreman at Pine Bluff, Ark. Position of assistant roundhouse foreman abolished.

RALPH MILLER appointed road foreman of engines, with headquarters at Illmo, Mo.

R. A. SCOTT, assistant supervisor of diesel equipment, appointed general diesel and steam locomotive foreman. Position of assistant supervisor abolished.

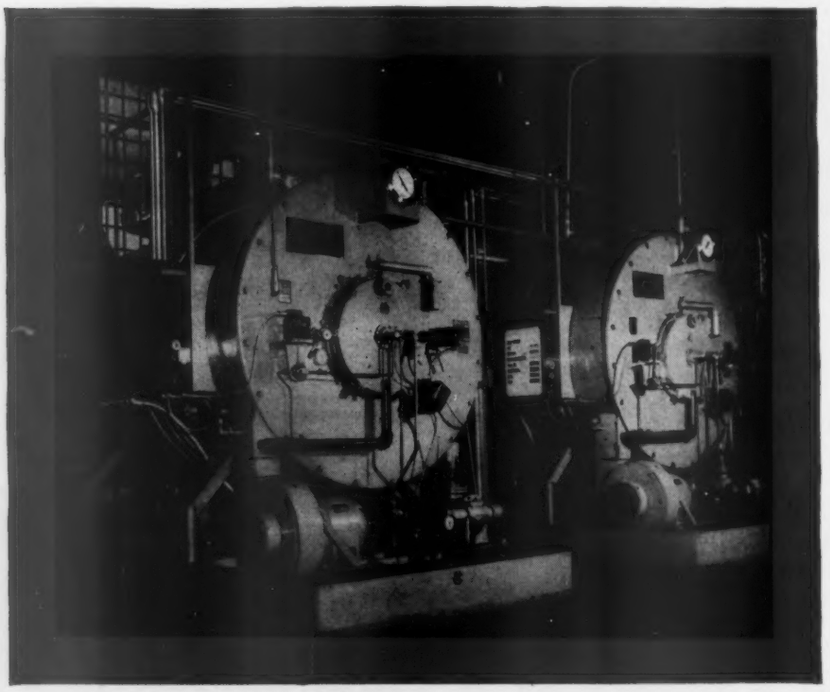
St. Louis Southwestern

M. P. NUNNALLY, assistant superintendent motive power, appointed engineer of motive power at Pine Bluff, Ark.

G. S. GANDY, master mechanic at Pine Bluff, Ark., appointed assistant superintendent of motive power, continuing the duties of his former position which has been abolished.

E. M. HERCHER, night roundhouse foreman at Pine Bluff, Ark., appointed diesel locomotive foreman. Position of night roundhouse foreman abolished.

CLIFTON E. BYNUM, relief foreman at Tyler, Tex., appointed mechanical foreman at Dallas, Tex.



AMESTEAM Pays For Itself In 3 Years on K. & I. T.

Here's tops in economy! The busy Kentucky & Indiana Terminal Railroad installed two 250 hp. AMESTEAM Generators and two electric compressors to service its Louisville roundhouse, shops and yards. This new power plant is netting this important switching railroad an annual saving of $15,000 to $20,000, equivalent to one-third the cost of the installation.*

The AMESTEAM Generator is completely automatic; no boiler room attendants are required. Burns all types of fuel oil from Bunker C down to No. 1, as well as natural gas. Better than 80% thermal efficiency is guaranteed. Single units from 10 to 600 hp. Design pressure — 15 to 200 lbs. *Phone, write or wire* for complete data.

***See article in this issue.*

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